

Chapter 7.0

Breathing System Maintenance and Repairs

7.1 Introduction

This chapter covers the maintenance and repair of all components of the breathing system. The breathing system includes the one way valve, the emergency valve, the side block, the bent tube assembly, the demand regulator, and the oral/nasal mask.

The breathing systems on all Kirby Morgan helmets and masks are simple and highly reliable. The fact that they can continue to operate when the components are not in a well-maintained condition can cause divers to become complacent about maintenance.

Your life depends on the correct function of this equipment!

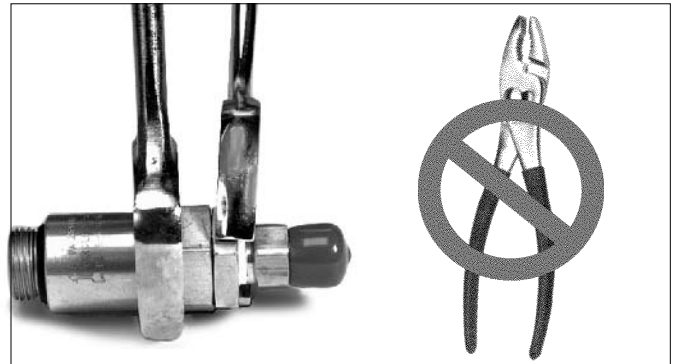
While Kirby Morgan helmets and masks are simple to maintain, like any type of life support equipment, they do require regular periodic maintenance to function properly.

All parts disassembled should be thoroughly cleaned using the methods described in the Appendix in the rear of this manual. Components that require the use of lubricants, sealing and thread locking compounds should also be maintained.

Most fasteners have a torque value, it is imperative that all fasteners which have a torque value be tightened to the torque specifications as outlined by the procedure, or as listed in appendix 1. If in doubt as to the proper torque setting, contact your local authorized repair facility or KMDSI.

7.2 One Way Valve

NOTE: *The one-way valve assembly should be disassembled, cleaned and the three O-rings should be replaced at least annually. Damaged and/or corroded parts should be replaced. A repair kit is available for replacement parts (525-330).*



CAUTION

Use two wrenches or hold the hex part of the body in a vise while removing or turning the seat with a wrench. Do not use pliers on the main body of the one-way valve. You may damage the valve if pliers are used.

7.2.1 Disassembly Of The One Way Valve

Tools Required:

Soft Jaw Vice

1 inch Open End Wrench Attachment on Torque Wrench

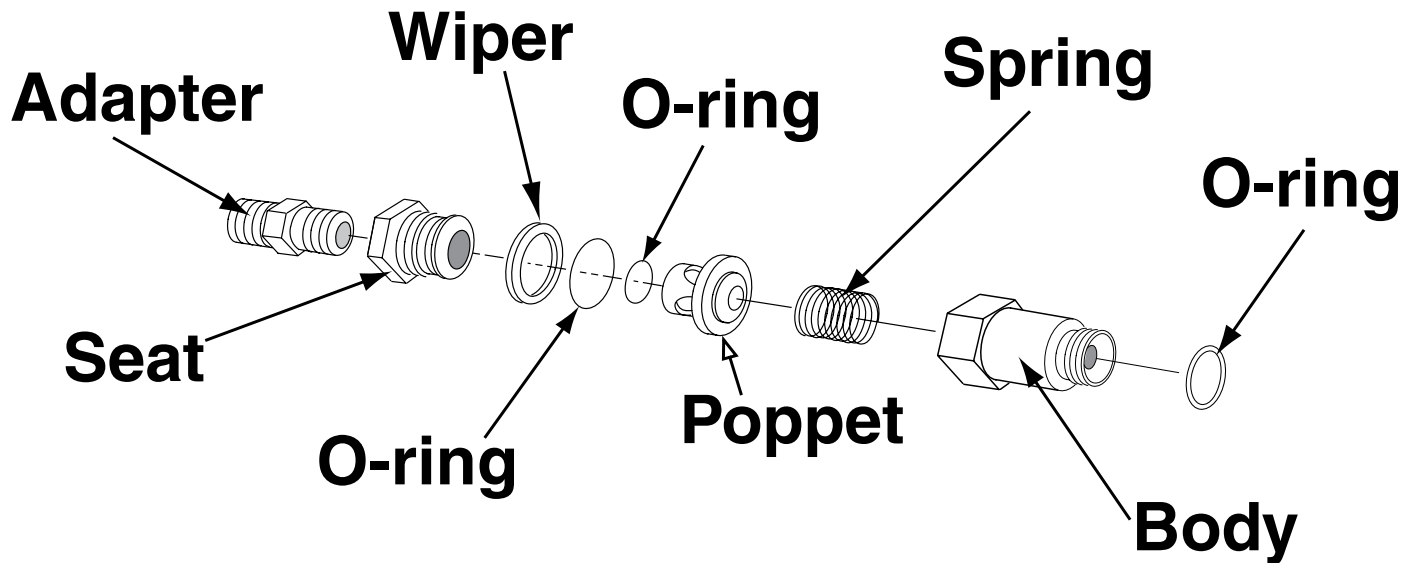
(If no vise is available use a backup 1 inch open end wrench)

To disassemble and inspect the one way valve assembly:

1) The one way valve assembly must be removed from the side block. Use the open end wrench to remove it.

2) After the one way valve has been removed, use two wrenches or hold the hex part of the body in a soft jaw vise while removing the seat with a wrench.

As the seat is removed, the wiper and the O-ring will slide out in place in a groove on the seat. The



Correct assembly order of the one way valve.

poppet and the poppet O-ring usually come out in the seat being followed by the spring.

The only functional part remaining in the valve body is a non-moving, pressed-in cage. The function of the cage is to prevent the poppet O-ring from blowing out of place during high flows. Do not remove the pressed in cage. This can only be done at the factory.

3) Inspect the body interior for foreign matter of any type and clean, if necessary. Clean in accordance with the cleaning instructions in Chapter 6. If corrosion is present, clean using the acidic solution as outlined in Chapter 6.

4) Inspect the seat, wiper, O-ring, poppet O-ring and poppet for wear, replace if necessary. Be sure each part is clean and all components are lightly lubricated with the appropriate lubricant. A repair kit is available for replacement parts. (Part #525-330)

5) Be careful to wipe the poppet and poppet O-ring thoroughly, removing nearly all silicone to prevent foreign materials from sticking to these components.

6) Replace the spring.

7.2.2 Reassembly of the One Way Valve

1) Slide the new O-ring over the poppet.

2) Insert the new spring into the valve body, followed by the poppet.

3) Next, install the new O-ring and new wiper on the

seat. Thread the seat into the valve body.

4) Tighten the seat to 150 inch lbs. (17 Newton meters) with a torque wrench while holding the body in a soft jaw vice or wrench.

5) If the adapter has been removed, it must be cleaned and wrapped with Teflon tape.

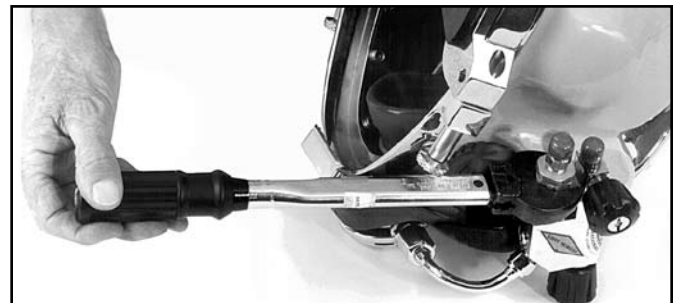


WARNING

Do not allow any Teflon tape to cover the end of the adapter, or to enter the one-way valve. Loose pieces of Teflon tape can interfere with the performance of the one-way valve or the regulator and may block the diver's air supply. This could lead to death through suffocation.

6) Test the operation of the valve.

7) Place the new O-ring on the end of the one way valve assembly and reinstall the valve assembly in the side block. Tighten to 150 inch lbs. (270 kg.cm.) with a torque wrench.



Tighten to 150 inch lbs. (17 Newton Meters) with a torque wrench.

7.3 Side Block Assembly

7.3.1 General

The side block should be overhauled at least annually, or whenever components show signs of wear, damage or do not function smoothly or properly. Minimum replacement components during overhaul includes all O-rings. A repair kit is available for replacement parts (Part #525-311).

The side block does not require removal from the helmet each time an overhaul is being conducted providing inspection of the internal passages does not reveal contamination or excessive corrosion. However, the side block should be completely removed at least every three years of active use to ensure fasteners are not corroded or frozen.

The side block assembly is held in place on the helmet shell by a stud, flat washer, lock washer, nut, and a machine screw. The screw does some securing but its main function is to prevent rotation of the side block. The stud also extends into the interior of the helmet shell far enough to secure the air train by means of the washer and nut.

The air train cup that fits over the stud is made of soft brass and cannot be used for a bearing surface to mount the side block. RTV silicone rubber compound is used to form a gas tight seal between the side block and the exterior of the helmet shell.

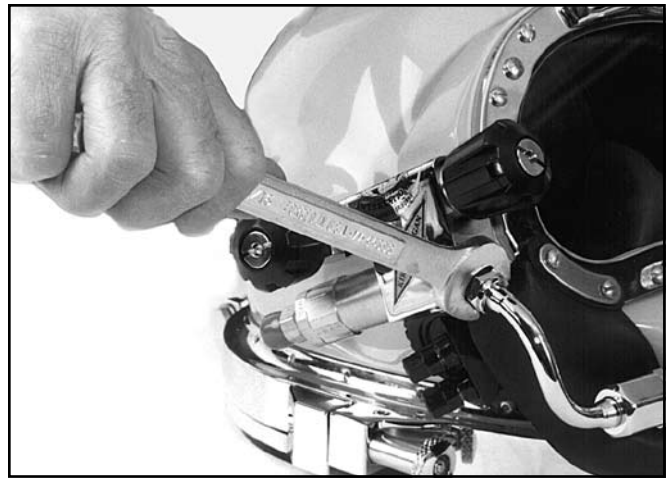
7.3.2 Side Block Assembly Removal

Tools Required:

7/16, 11/16, and 7/8 inch Open End Wrenches
11/16 and 7/8 inch Open End Wrench Attachment on Torque Wrench
1/4 inch Flat Blade Stubby Screwdriver

The bent tube assembly must be entirely removed before removal of the side block assembly is started.

- 1) Completely unscrew the bent tube assembly nut (14) from the side block.
- 2) Using two wrenches, hold the nut at the regulator end of the bent tube assembly with the first wrench. With the other wrench, loosen the jam nut (100) by turning the wrench DOWN.
- 3) Unscrew the bent tube nut until it comes free, then pull the bent tube assembly straight out of the regulator inlet nipple.
- 4) The side block assembly is ready to be separated from the helmet shell at this time.



Loosening the bent tube from the side block.

7.3.3 Separating the Side Block Assembly from the Helmet Shell

Tools Required:

Putty Knife
7/16 inch Open End Wrench
1/4 inch Flat Blade Stubby Screwdriver

- 1) Removal of the side block assembly requires removing the air train.
- 2) Remove the nut and washer that secure the air train, then the air train itself.
- 3) The stud nut is removed next, with the lock washer and flat washer.



Loosening the nut that holds the air train.

- 4) Next, the alignment screw is removed.

NOTE: The alignment screw is located in a recess in the fiberglass next to the stud. This recess is normally filled with RTV. The RTV must be scraped free to reveal the screw.



A thin putty knife helps to remove the side block.

5) The side block assembly is now unfastened, but held in place by the rubber sealing compound (silicone sealant) that acts as a glue. It may be necessary to rock just slightly, or pry the side block from the helmet shell. A thin putty knife can be pushed between the side block and the helmet shell to help free it. **Do not use a screwdriver or chisel as damage to the shell could result.** Be sure to peel or scrape the old silicone sealant away from both sealing surfaces before reassembling. Acetone helps remove this, but must be used sparingly since it will also remove the

flat black finish inside the helmet.

6) If you plan to rebuild the side block assembly, it should be done at this time, while the side block is off the helmet. Overhaul the defogger valve and emergency valve in accordance with this chapter. Overhaul the one-way valve in accordance with this chapter.

7.3.4 Side Block Assembly Replacement

If a new side block is being installed, make sure it aligns correctly in the holes of the helmet shell before applying RTV silicone sealant.

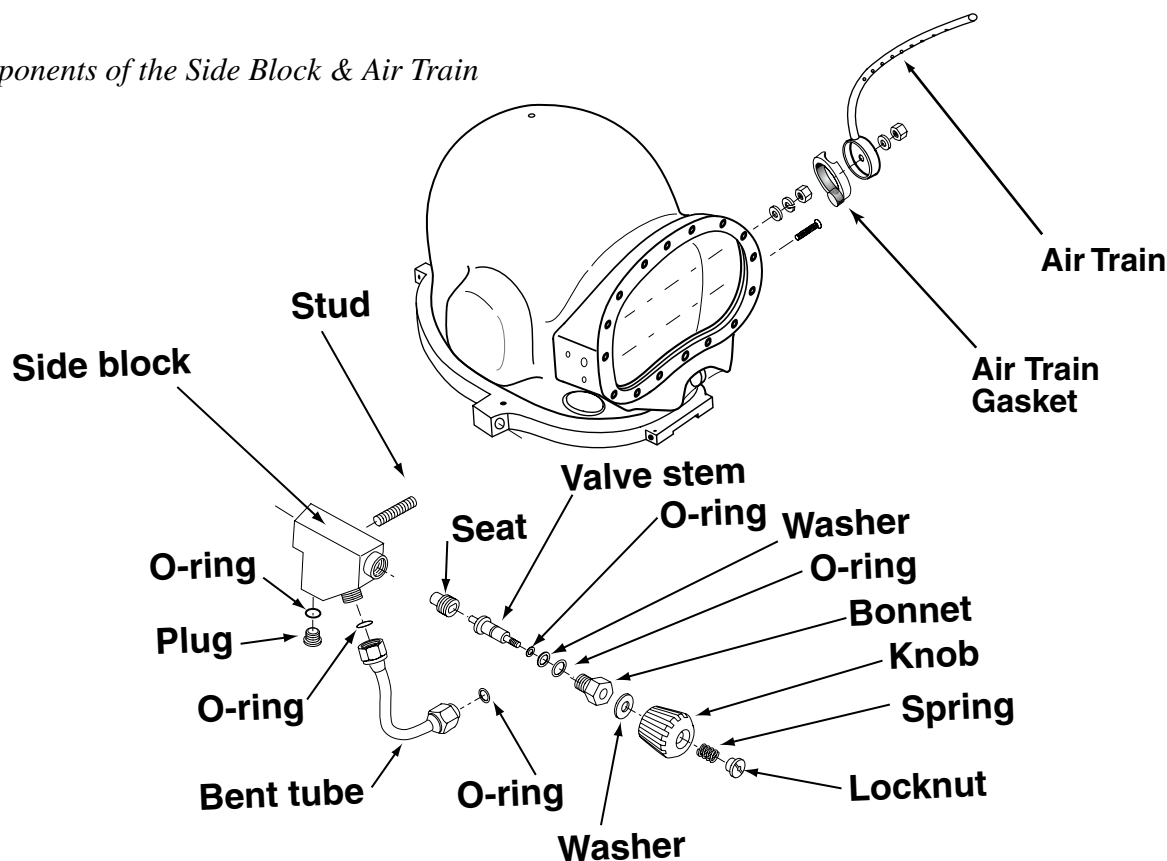
1) A generous application of silicone sealant must be applied to the side block prior to installation on the helmet shell. The sealant should surround the stud, alignment screw, and air inlet on the block. Use only Dow Corning™ RTV 732 Multi Purpose sealant. This work must be done in a well-ventilated area.

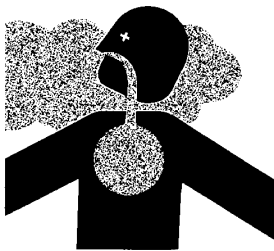
Care must be taken to avoid sealant entering the air opening in the side block. Be sure to remove all excess silicone sealant before it sets up. Lacquer thinner can be used to dissolve uncured sealant, after tightening.

2) Fit the side block to the helmet shell.

2) Thread the screw through the helmet shell and lightly tighten into the side block body.

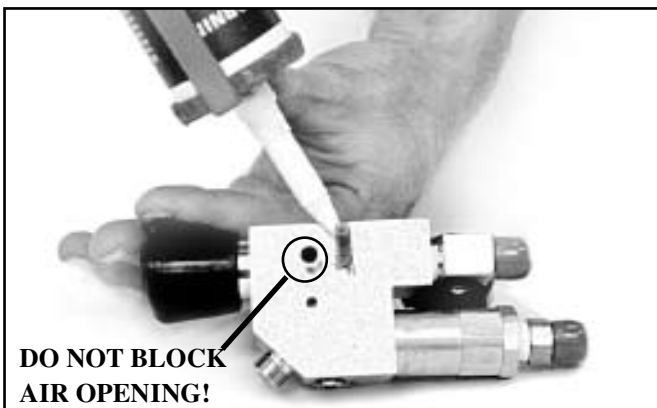
Components of the Side Block & Air Train



! WARNING

Use silicone sealant in a well ventilated area. Do not breathe the fumes from uncured silicone sealant. These fumes are dangerous and can cause unconsciousness. They can

also cause long term damage to body tissue. Read and follow all precautions listed on the silicone sealant tube and Material Safety Data Sheet.



A generous application of silicone sealant must be applied to the side block prior to installation on the helmet shell. Use only Dow Corning™ RTV 732 Multi Purpose sealant.

3) Slide the flat washer and the lock washer onto the stud. Run the stud nut down the stud and tighten to 35 inch pounds (4 Newton meters). **Do not over-tighten!**

4) Tighten the screw to the correct torque, 35 inch pounds. Clean off all excess silicone sealant.

5) Place the air train gasket on the base of the air train. The knob on the base of the air train gasket is designed to cover the recessed hole where the bolt that helps maintain the position of the air train is installed. Slip the air train over the stud. Align the air train with the upper edge of the view port opening in the helmet shell.

6) Place the washer on the stud and tighten the nut until the washer lays flush on the air train, 15 inch pounds. **Do not overtighten!**

7) Test the side block prior to diving to ensure that no silicone sealant is blocking the air flow to the helmet.

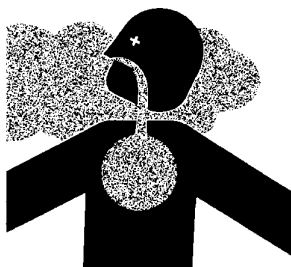
If it is, it must be cleaned out prior to diving.

! WARNING

Do not dive the helmet until the sealant has had time to cure. Check the directions on the tube of sealant for curing time. If the helmet goes into the water before the sealant has cured it could leak through the side block mounting stud hole, screw hole, or air flow hole. This could lead to drowning.

! WARNING

If silicone sealant is blocking the air flow into the helmet it must be cleaned out. If it is not, the diver may not be able to properly defog the helmet or clear a flooded helmet quickly. In addition, if the demand regulator is not delivering air properly, the diver cannot use the free flow system as a source of breathing air. This could lead to suffocation.

! WARNING

Avoid breathing fumes from lacquer thinner and use in a well ventilated area. Breathing fumes can lead to nervous system damage, unconsciousness, and death.

! WARNING

Avoid skin contact with lacquer thinner. Wear rubber gloves. Lacquer thinner can damage the nervous system.

! WARNING

Avoid eye contact with lacquer thinner. This chemical is an irritant and may cause tissue damage.

7.4 Defogger Valve

7.4.1 Disassembly of the Defogger Valve

Tools Required:

3/8 inch Slotted Flat Blade Screwdriver

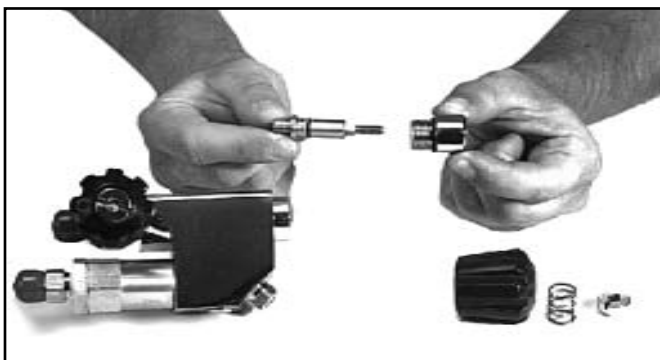
13/16 inch Open End Attachment on Torque Wrench

The defogger valve components are disassembled as follows:

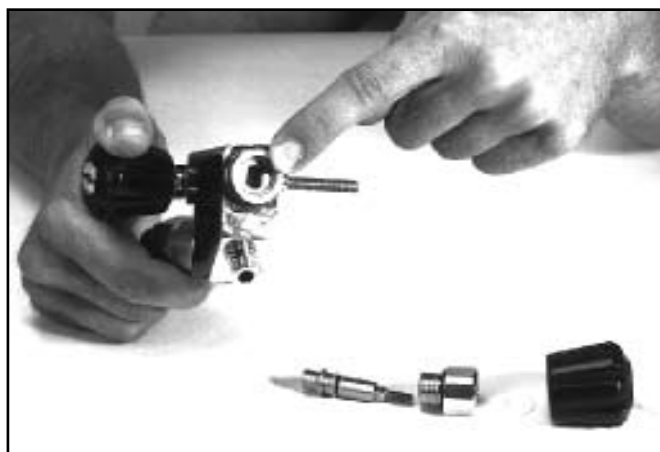
- 1) First, unscrew the control knob lock nut and remove the spring, control knob, and washer.



Remove the defogger control knob.



The valve stem usually comes out with the bonnet.



The seat should be removed for inspection.

- 2) Next, unscrew the bonnet. Its o-ring will come off with it. The valve stem, o-ring, and washer usually come out with the bonnet and can be pushed out of the bonnet once removed from the side block.

- 3) If the stem remains in the side block body it can be lifted out after the bonnet is removed.

- 4) The seat assembly can be unscrewed from the side block body with the stem or a screwdriver.

7.4.2 Cleaning and Lubricating

- 1) Clean all the metal first in the soapy water solution and then in a 50/50 dilute solution of white vinegar/water. Rinse in fresh water.

- 2) Check the Teflon® seat for wear and/or contamination, and replace if necessary. Damage such as a rough face or cuts to the seat indicate it must be replaced.

- 3) The Teflon® washer and O-ring must be replaced if worn.

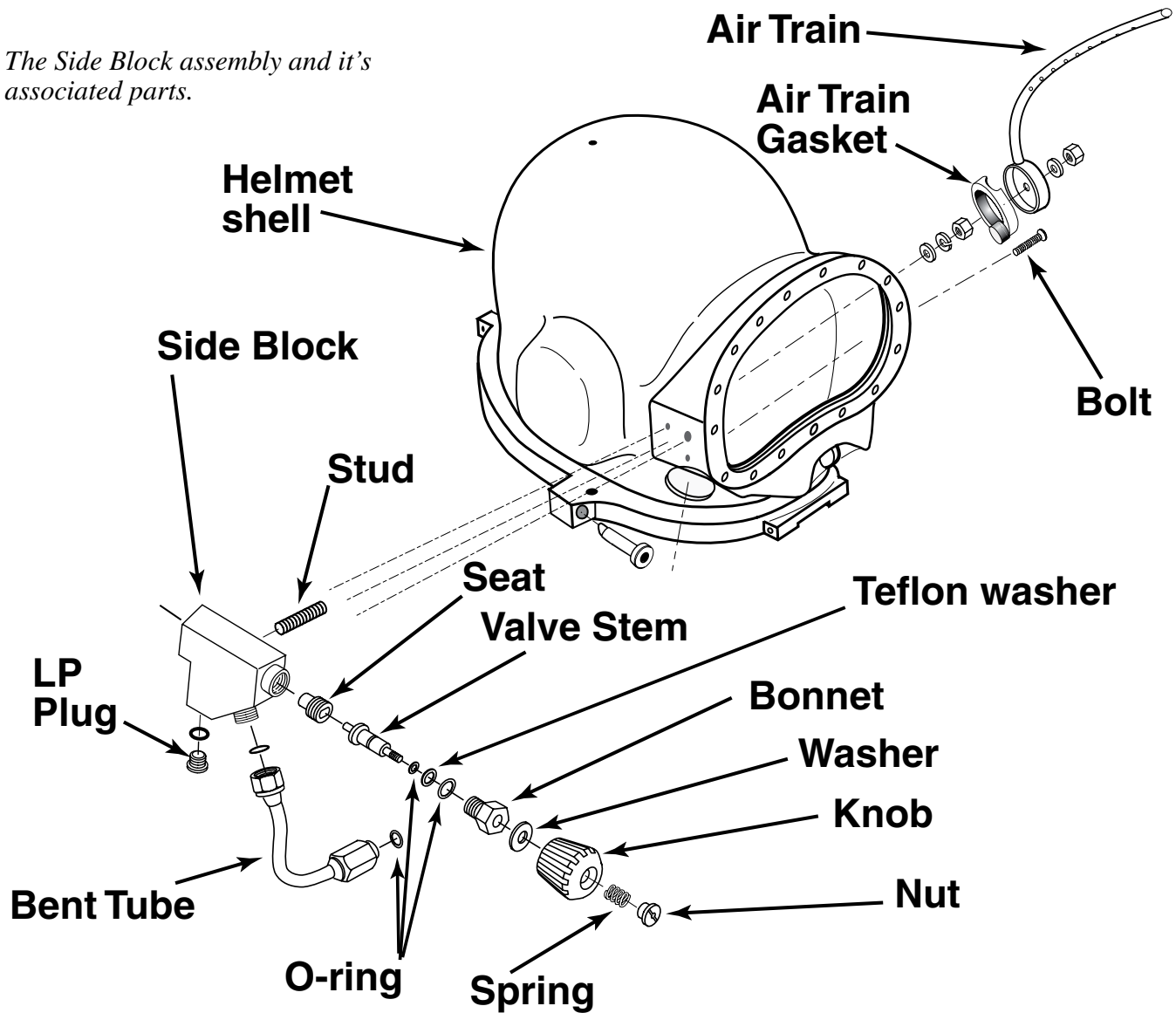
- 4) Be sure to place a light coating of silicone grease on all internal moving parts, O-rings, and washers. However, do not lubricate the Teflon® seat, as this will attract dust and debris.

- 5) Inspect the seat area inside the side block and replace the block if damaged.



Clean all the metal parts to remove salts.

The Side Block assembly and it's associated parts.



7.4.3 Reassembly of the Defogger Valve

Tools Required:

3/8 inch Slotted Flat Blade Screwdriver

13/16" Open End Attachment on Torque Wrench

Minimum recommended replacement parts during overhaul:

Washers, O-rings

- 1) Screw in the new seat assembly until it is even with the front of the side block body.
- 2) Next, install the Teflon® washer and O-ring onto the stem.
- 3) Insert the proper end of the stem into the seat assembly and turn clockwise until the seat lightly bottoms out. Leave the stem in place.
- 4) Lubricate the O-ring and install on the bonnet.
- 5) Slide the bonnet over the stem and thread the bon-

net into the side block.

- 6) Tighten the bonnet with a torque wrench to 100 inch lbs.

- 7) Place the new Teflon® washer and the control knob on the stem and rotate the stem counterclockwise until the seat assembly tops out fully open. The control knob must turn smoothly without any binding.

Binding (or "hard spots") in the rotation could be an indication of a bent stem that should be replaced. Replace the knob and or stem if the fit allows the valve to rotate loosely more than 1/8th of a turn.

- 8) Install the new Teflon® washer, new knob, and the spring, and locknut. Tighten the locknut until it is flush with the knob.

7.5 Emergency Valve Assembly

The Emergency valve control knob is not interchangeable with the defogger valve control knob.



WARNING

The control knob for the emergency valve and the defogger knob are not interchangeable. Use only the correct knob for the appropriate valve.

7.5.1 Disassembly of the Emergency Valve

Tools Required:

11/16 inch Open End Wrench

1 inch Open-end Wrench

Torque Wrench Attachments & Torque Wrench

3/8 inch Slotted Flat Blade Screwdriver

Soft Jaw Vice

Lubricant

Teflon Tape

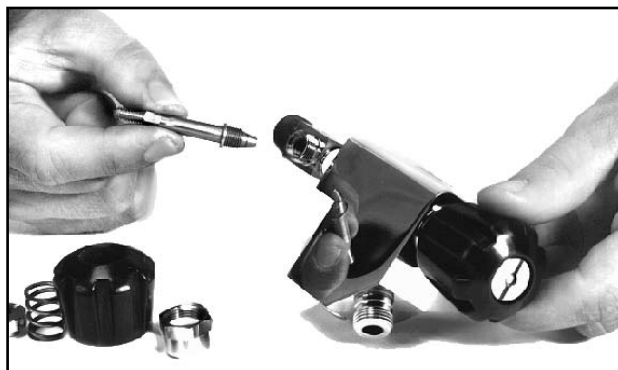
- 1) Remove the lock nut, spring, and knob.
- 2) Undo the packing nut, and remove the packing, and washer.
- 3) When the packing nut is free of the threads of the emergency valve body, back out the stem until it is free of the emergency valve body.



Remove the lock nut, spring and knob.



Undo the packing nut.



Remove the valve stem.

7.5.2 Cleaning and Lubricating

1) Clean all the metal parts in a soap and water solution, followed by cleaning with a 50/50 dilute solution of white vinegar/water. Rinse with fresh water. Clean all parts. See the cleaning instructions in Chapter 6.

2) Inspect the packing and washer for wear and replace if necessary. Normally the packing will last a very long time and does not require replacement as long as the valve operates smoothly and does not leak. To replace the packing place the packing nut in a vise and carefully work the packing out with a small screw driver, taking care not to damage the threads of the packing nut. Replace the washer if needed.

3) Inspect the stem seat for unevenness or wear and replace if necessary. It must also be replaced if the stem is bent. Damage will include damaged threads, rounded flats that engage the control knob. Also inspect the shaft to ensure the conical seat surface is smooth and free of corrosion or damage.



Inspect the packing and washer.

4) Check the seat in the emergency valve body for wear or unevenness, galling and corrosion. Check the seat on the emergency valve stem. To clean up the seat surface use a pencil eraser to buff the surface. Inspect all threaded surfaces for damage. Replace the emergency valve body if any damage is found.

5) To remove the emergency valve body from the side block the one way valve assembly must first be removed.

6) If the emergency valve body was removed, clean and inspect the pipe thread and inspect for damaged threads, cracking or distortion. Replace the emergency valve if any damage is present.

Re-tape threads with Teflon tape, 11/2 wraps starting two threads back, tighten using good engineering practice. To reinstall the emergency valve body onto the side block, the one-way valve assembly must be removed first.

7.5.3 Reassembly of Emergency Valve

1) Lightly lubricate the stem threads in the body as well as the bonnet threads.

2) Replace the washer and packing on the stem , then lightly lubricate the stem shaft and threads.

NOTE: *There are two different packing (s) and washers supplied in the kit (525-311), for rebuilding both the older style and the newer high flow emergency gas valve. Match the removed packing and washers to the new ones supplied and discard the others.*

3) Holding these components in place on the stem, screw the stem into the emergency gas valve body.



Installing the packing nut on the valve stem.

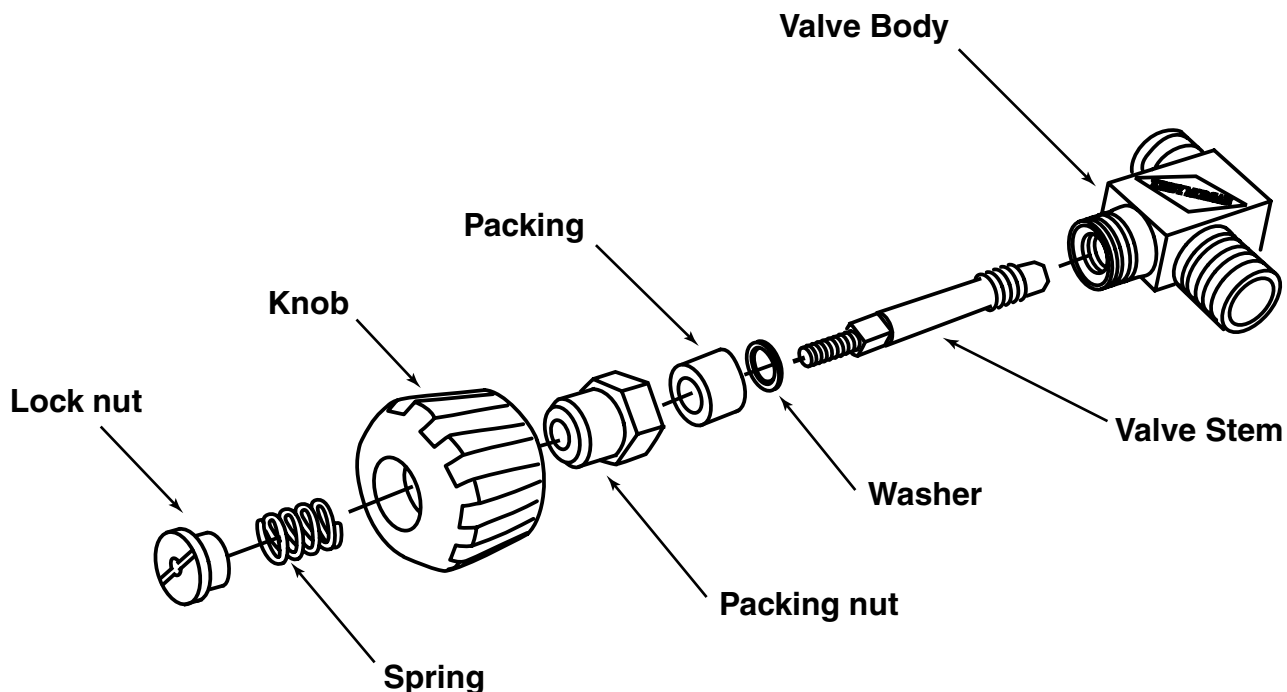
4) Rotate the stem until it is seated all the way in then, back it out -1/2 turn.

5) Thread the packing nut onto the emergency valve body. Run the nut in and tighten slightly with a wrench.

6) Inspect the emergency gas valve knob for wear and damage. Ensure the flats that engage the valve stem shaft are not rounded, cracked or damaged. The valve knob should not have rotational play greater than 1/8th of a turn.

NOTE: *This knob is not interchangeable with the defogger valve knob.*

7) Place the emergency gas valve knob onto the stem



The emergency valve

**WARNING**

The control knob for the emergency valve and the defogger knob are not interchangeable. Use only the correct knob for the appropriate valve.

and rotate the stem all the way out, then back again. The rotation must be smooth. If “hard spots” or unevenness are felt during the rotation, the stem may be bent and could need replacement.

8) Tighten the packing nut with a torque wrench until moderate resistance is felt when turning the knob. Torque to 50 inch pounds after seating.

9) Place the spring, and locknut onto the stem securing the knob.

10) Tighten the locknut until its top is flush with the top of the knob. The assembly is now complete and ready for testing.

NOTE: If the valve was removed from the side block testing of the emergency gas valve is easily accomplished by attaching the valve, by itself in the shut position, on to the bail-out whip from the first stage. Pressurized to a minimum 135 p.s.i.g. (9.3 bar) using the EGS Cylinder and dropping it into a bucket of clean water a minimum 30 seconds to check for leaks.

11) Before wrapping the threads with pipe tape, check the fit of the valve assembly pipe threads to the mating threads of the side block. There should be 2 turns of hand make up before needing to use a wrench.

**WARNING**

Use only thin Teflon tape when installing the Emergency Gas Supply valve in the side block. Thick tape can lead to thread damage, which may make it impossible to install the EGS valve in the side block properly. This could lead to a loss of breathing gas.

If there is less make up, then the threads will need to be chased with a 1/4” NPT tap to obtain the proper make up. If thread chasing is required, the bent tube assembly, the one way valve assembly and steady flow components must all be removed and the side block body must be thoroughly cleaned to remove any loose particles.

12) Before installing the valve assembly, wrap the pipe threads with 1-1/2 turns of Teflon tape starting after

the first thread. Apply the tape with slight tension to allow the tape to fill into the threads.

Hand tighten the valve, then continue an additional 1-1/2 to 2 turns with a wrench keeping in mind the proper alignment of the control knob to the side block. Also, there should be at least one male thread visible. Check to be certain the valve is tight by trying to loosen the fit by hand.

DO NOT TIGHTEN THE VALVE BODY TIGHTER THAN NECESSARY! OVER TIGHTENING MAY OVERSTRESS THE PART AND CAUSE THE PART TO FAIL.

It is NOT necessary to have the control knob for the emergency gas supply valve perfectly “square,” i.e., at a 90 degree angle to the side block. Any angle is acceptable provided that 1) the valve handle can be turned easily and 2) the diver can locate the handle easily.

7.5.4 Leak Testing the EGS Valve

a) Attach supply whip from the EGS first stage to EGS helmet valve.

b) Ensure the defogger valve knob is open and the EGS Valve is shut.

c) Pressurize EGS Valve to a minimum of 135 p.s.i.g. (9.3 bar) using the EGS cylinder as supply. Allow system pressure to stabilize, and then shut the EGS supply cylinder valve. Note time and final stabilized system pressure.

d) Perform the leak check for minimum of five minutes, using the mild soapy solution, per Chapter 6. Ensure there is no gas flowing or pressure drop in the system. There should be no visible signs of external leakage if the valve is operating properly.

**WARNING**

A leaking Emergency Gas Valve assembly can cause the diver to exhaust his entire EGS (bailout) without his knowledge. This may lead the diver to mistakenly assume his EGS supply is available when it is not. This could lead to panic or drowning in an emergency. Any worn or damaged components must be replaced.

A submersible pressure gauge should always be used with the EGS system to help minimize this risk.

7.6 Bent Tube Assembly

7.6.1 General

The bent tube assembly provides breathing gas flow from the side block assembly to the regulator assembly on the Kirby Morgan 37. Both ends of the bent tube assembly disconnect for complete removal. The O-ring and the Teflon O-ring should be replaced during normal overhauls or any time these components are deemed unserviceable.

These components do not require replacement during field repairs providing a careful visual inspection does not reveal wear or damage. All soft goods should be carefully cleaned in accordance with Chapter 6 prior to inspection for reuse.

7.6.2 Removal of the Bent Tube Assembly

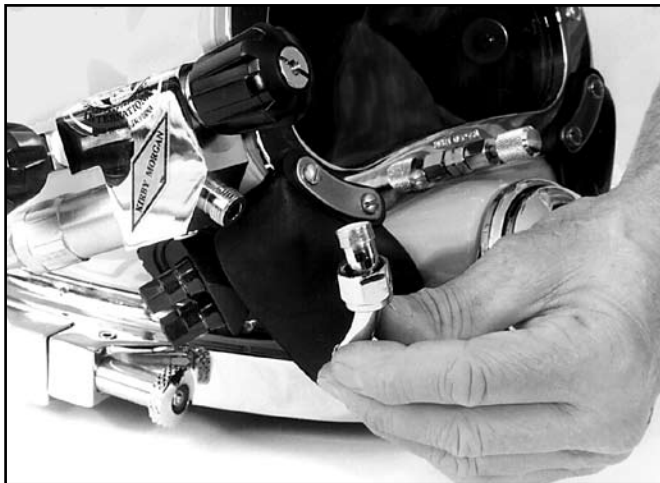
Tools Required:

11/16 inch Open-end Attachment on Torque Wrench

7/8 inch Open-end Attachment on Torque Wrench

7/8 inch Open-end Wrench

1) Always start removal of the bent tube at the side block end. The free swiveling mount nut on this end of the bent tube can be unthreaded completely and can slide down the tube.



Always start removal at the side block end.



Loosening the jam nut.

2) The inlet nipple has a jam nut that locks the mount nut in place. With one wrench, hold the bent tube mount nut. With another wrench, turn DOWN the jam nut, backing it away from the mount nut. The mount nut can then be rotated until free of the regulator inlet nipple threads. It can be pushed up the bent tube.

3) With the two mount nuts free; the bent tube assembly can be pulled straight out of the regulator inlet nipple. The bent tube assembly can be rotated back and forth to aid removal.

7.6.3 Inspection of Bent Tube Assembly

Clean the bent tube in accordance with Chapter 6. The O-ring at the regulator end should be cleaned and inspected whenever the bent tube is removed.

Replace the bent tube if it is excessively scratched dented or compressed deeper than 1/8 inch. If the helmet has been used for burning jobs, carefully check for erosion of the metal or severe corrosion. Replace if any erosion is present or integrity is in question. Keep in mind the bent tube is a critical component that routes breathing gas to the helmet systems.



Replace the O-ring on the bent tube if it is worn or damaged.



WARNING

Do not wrap the bent tube with tape, ropework, springs, hose wrap, or other items. This will prevent daily inspection of the bent tube. In addition, some of these items may trap moisture, which could lead to corrosion and failure of the bent tube.

If the tube fails, this could lead to a rapid depletion of the diver's breathing gas supply. This could lead to serious personal injury or death.

7.6.4 Installation of the Bent Tube Assembly

Tools Required:

11/16 inch Open-end Torque Wrench Attachment

7/8 inch Open-end Torque Wrench Attachment

7/8 inch Open-end Wrench

Normal minimum replacement parts during over-haul:

O-ring, Teflon® ring

1) Lightly lubricate the bent tube O-ring and install in the O-ring groove at the regulator end of the bent tube, then install new Teflon® O-ring at the side block end.

2) Push the regulator end of the bent tube assembly into the inlet nipple. Slide it in until the side block end of the tube is aligned with the threads for the mount nut.

3) Be sure the Teflon® O-ring is in place on the side block end of the bent tube, then engage the threads on the tube to the side block and hand tighten.

4) Start the “regulator to bent tube” mount nut onto the inlet nipple of the demand regulator and run it in by hand as far as it will go.

NOTE: Run the mount nut up on the inlet nipple hand tight only.

5) Using a torque wrench, tighten the bent tube assembly mount nut onto the side block to (100 inch lbs).

6) Hold the mount nut on the end of the bent tube with a wrench and tighten the jam nut against it with a torque wrench to 40 inch pounds.

7.7 SuperFlow 350 Demand Regulator

7.7.1 General Regulator Information

While the regulator systems on all Kirby Morgan helmets are simple and highly reliable, the breathing resistance will increase if the demand regulator on your helmet is not maintained or adjusted properly. The demand regulator must receive regular maintenance to assure the best performance possible. However, in the event the demand regulator is damaged, there is always a backup supply of steady flow gas available from the defogger valve.

If the regulator does not breathe easily, the diver cannot work hard and will tire rapidly. Simply put: If the demand regulator does not work properly the diver cannot work properly. This makes the maintenance of the demand regulator assembly essential.

For the gas inlet valve and adjustment system to operate properly, the components in the demand regulator **MUST** be in good condition and **MUST** be periodically inspected and adjusted.

Four special tools, the inlet valve holder (Part #525-616), the regulator adjustment wrench (Part #525-611), the socket wrench (Part #525-612), and the castle wrench (Part #525-618) should be used to work on the SuperFlow 350 regulator whenever possible.

Disassembly, assembly, and adjustment can be done without these tools, but the work is much easier and the adjustment is better if these tools are used. The above 4 tools are available together along with a tool case. The “Tool Kit with Pouch” is Part #525-620. This kit is included with each new Kirby Morgan helmet that is equipped with the SuperFlow 350 regulator.



Tool Kit with pouch - Part #525-620.

7.7.2 SuperFlow 350 Demand Regulator Test for Correct Adjustment, Fully Assembled

To maintain optimum performance of the demand regulator, it should be checked for proper function and adjustment prior to commencement of diving each diving day, in accordance with the KMDSI Daily Set Up and Functional Checklist. See the Dive Lab website (www.divelab.com) for the latest procedures for set-up.

Check the regulator for adjustment and proper function with the assembly complete, and supplied with a breathing gas supply pressure of 135 to 150 p.s.i.g.

NOTE: 135 to 150 p.s.i.g. over ambient is the standard supply pressure to be used when adjusting all KMDSI helmets and band-mask equipped with the SuperFlow 350 regulator. See Section 2.5 for recommended pressures during use.

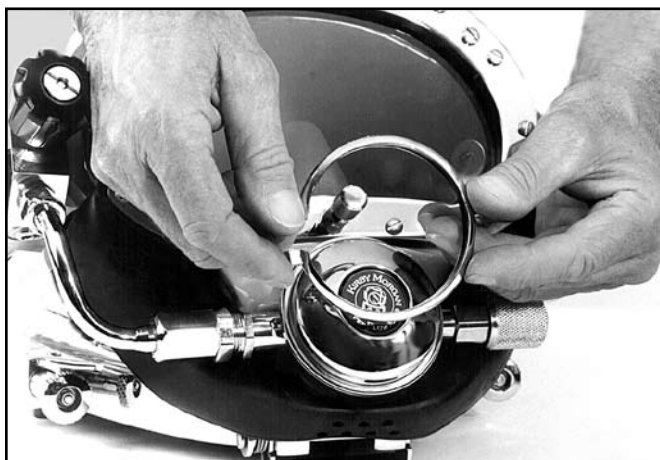
NOTE: When storing the helmet for any length of time, ensure that the regulator adjustment knob is turned “out” fully counterclockwise to avoid stressing the bias springs. This will prolong the life of both the inlet valve, seat, and bias springs.

- 1) Rotate the regulator adjustment knob in, towards the regulator body.
- 2) Ensure the supply pressure is connected and properly adjusted to 135 to 150 p.s.i.g.
- 3) Turn on the gas supply.
- 4) Rotate the adjustment knob out counterclockwise slowly, until a slight steady flow develops.
- 5) Slowly rotate the adjustment knob in clockwise, until the free flow stops. Lightly depress the purge button several times and ensure the gas flow has stopped.
- 6) Lightly depress the purge button. There should be between 1/16” and 1/8” free travel in the button before gas flow starts. When the button is fully depressed, a strong surge of gas must be heard.
- 7) If the purge button travels less than 1/16” or greater than 1/8” before free flow is heard, the demand regulator requires internal adjustment, per this chapter.

7.7.3 Inspection of SuperFlow 350 Regulator Body Interior

Tools Required:

1/4 inch Flat Blade Attachment on Torque Screwdriver



Remove the demand regulator clamp.

- 1) Remove the demand regulator clamp by removing the clamp screw.
- 2) Lift off the regulator cover and diaphragm.
- 3) Clean the diaphragm with the soapy solution, per Chapter 6 and wipe dry. Inspect the diaphragm for holes, tears or any signs of deterioration by holding it up to a white light and stretching and pulling. Check for a good bond between the metal disc and the silicone. Replace diaphragm if any doubt exists.
- 4) Inspect the interior of the demand regulator body for damage, corrosion and cleanliness. Clean the interior of the regulator body if necessary per Chapter 6.
- 6) Reinstall the diaphragm, cover, and clamp. Tighten the clamp screw to the recommended torque to 12 inch pounds using a torque screwdriver.



WARNING

Use only replacement diaphragms manufactured by Kirby Morgan. Use of other diaphragms may degrade performance and may cause increased breathing resistance. This can lead to fatigue and the inability to work at full capacity.

NOTE: Older regulator clamps, when properly torqued, had a gap of approximately 1/32" to 1/16" between the retaining clamp surfaces when fully tightened. All new clamps when properly torqued, have little or no gap between the retaining clamp surfaces.

7.7.4 SuperFlow 350 Demand Regulator Bias Adjustment Servicing, Demand Regulator on the Helmet

Note: This procedure should be used when replacing the O-ring on the adjustment shaft and or cleaning and lubricating the shaft threads during field repairs of the demand regulator on the helmet. Start at the adjustment knob end of the regulator:

Tools Required:

3/4 inch Open-end Wrench Attachment on Torque Wrench

3/32 inch Punch & Small Block of Wood

Ball-Peen Hammer

Regulator Adjustment Tool Kit, Part #525-620

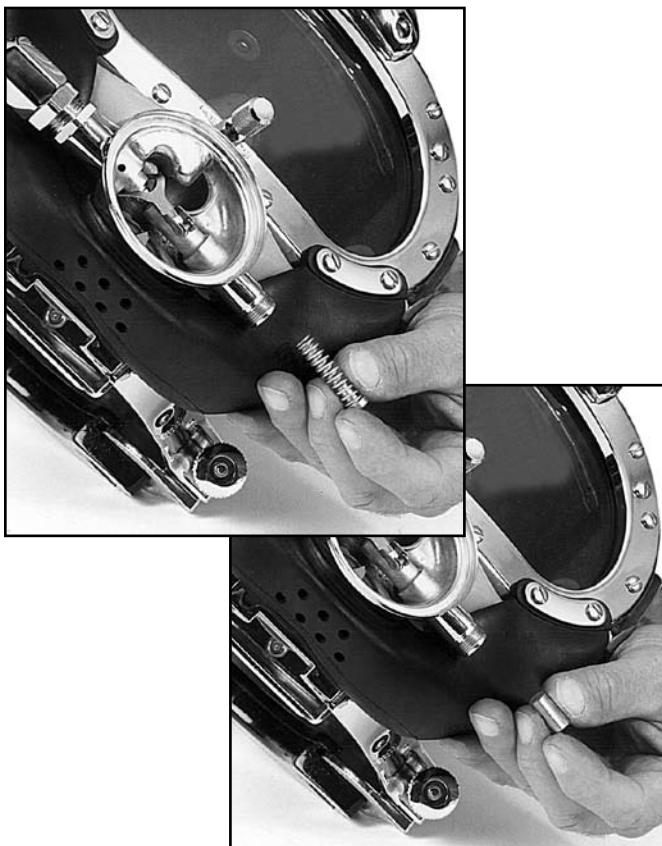
Torque Wrench

- 1) Unscrew the regulator adjustment knob until it stops. If the knob wobbles as you turn it, or is extremely hard to turn, the shaft is bent and needs to be replaced.



Screw the regulator adjustment knob out for removal.

- 2) Loosen the nut, then rotate the adjustment knob counterclockwise until the adjustment knob and the adjustment shaft are free.
- 3) Remove the spacer, springs, and piston. At this point the threads can be cleaned and lubricated as well as the adjustment shaft.
- 4) Punch out the roll pin using a 3/32 punch. Use a block of wood with a 1/4" hole drilled through it to support the knob. Position the knob so the roll pin



Shake out the spacer, spring set, and piston.

is over the hole. The adjustment knob can be held against the wood block allowing the roll pin to be driven into the 1/4" hole.

5) Remove the adjustment knob, the washer and O-ring.

NOTE: If the spacer and the spring set are stuck, this could indicate corrosion or possible saltwater intrusion into the adjustment tube and assembly, or that the adjustment tube is bent. The demand regulator should be removed from the helmet and cleaned and inspected, per this Chapter..

6) Carefully inspect all parts for corrosion, paying particular attention to threaded surfaces and the spring set. Clean and lightly lubricate parts per the instructions in this chapter.

NOTE: Carefully inspect the adjustment shaft to ensure it is straight, Check for damaged threads. Replace the adjustment shaft if any damage is found. Replace the O-ring.

7) Replace washer.

8) Replace the O-ring.



Inspect the washer and o-ring.

9) Inspect the inside of the adjustment tube on the regulator body to be sure there is no corrosion and the adjustment assembly can travel freely. Ensure the alignment tube is not bent or misaligned from impact, and that the threads are clean.

NOTE: If the inside of the adjustment tube is corroded, this indicates saltwater intrusion into the adjustment tube and assembly. The demand regulator requires removal from the helmet and cleaning per this Chapter.

7.7.5 Reassembly of the SuperFlow 350 Regulator Adjustment System

Tools Required:

3/4 inch Open-end Wrench Attachment on Torque Wrench

Silicone grease, or oxygen compatible grease if used for oxygen service.

1) Lightly lubricate the piston and spacer and place the piston back in the regulator adjustment tube, followed by the spring set, and spacer.

2) Lightly lubricate the adjustment shaft end and threads, install the washer and the lightly lubricated O-ring on the adjustment shaft.

3) Slip the packing nut over the adjustment shaft followed by the adjustment knob.

4) Hold the shaft and rotate the knob until the pin holes line up. Use the inlet valve holder from the regulator tool kit to accurately align these holes. Using a small hammer drive the retaining pin back into place, until it is flush with the surface of the adjustment knob.

5) Screw the adjustment knob assembly clockwise back into the regulator body leaving enough packing nut exposed to get the wrench on it.

NOTE: Ensure the adjustment shaft (85) rotates smoothly.

6) Thread the packing nut onto the regulator body (81) and tighten with the 3/4" torque wrench to 40 inch pounds after seating, turn the knob all the way in and all the way out making sure there is no interference.

7.7.6 SuperFlow 350 Demand Regulator Removal from Helmet

Tools Required:

Torque Wrench and 1 3/8 inch Socket

1 /4 inch Flat Blade Attachment on Torque Screw-driver

Torque Wrench and 11/16 Open-end Attachment

Torque Wrench and 13/16 Open-end Attachment

Torque Wrench and 7/8 inch Open-end Attachment

7/8 inch Open-end Wrench

1) To remove the regulator from the helmet, the bent tube should be disconnected first. The bent tube assembly should be loosened at the side block and disconnected from the regulator. It may now be swiveled out of the way or completely removed.

2) Remove the whiskers from the port retainer (108) by removing the screws. Take care not to lose the spacers or kidney plates.

3) Remove the nose block device per Chapter 8.

4) Remove the oral nasal mask.

5) The regulator mount nut is removed along with the sealing O-ring.

6) Cut the tie wrap that connects the regulator body to the Quad Valve cover.

7) Now the regulator assembly can be pulled out of the helmet.

8) The center section of the exhaust whisker, named the exhaust main body has a tie wrap holding it in place. Remove the tie wrap then stretch the body off the regulator exhaust flange.

9) Older model double or single exhaust whiskers are removed similarly.



The regulator mount nut must be removed to remove the regulator.

7.7.7 Disassembly of the SuperFlow 350 Demand Regulator

Tools Required:

1/4 inch Flat Blade Screwdriver on Torque Wrench
7/8 inch Open-end Attachment on Torque Wrench
3/4 inch Open-end Attachment on Torque Wrench
3/32 inch Punch 7/8 inch Open-end Wrench
Small Ball Peen Hammer
KMDSI Tool Kit Part #525-620
Silicone Adhesive Dow Corning 732 or equivalent
Minimum Recommended Replacement Parts for Annual Overhaul:
Inlet valve Soft Seat 510-580
Adjustment shaft O-ring 510-011
Adjustment Shaft Washer 520-032
Adjustment Nut 530-303
Diaphragm 510-553
Inlet Nipple O-ring 510-014
Exhaust valve 510-552

- 1) Remove the regulator cover clamp screw and clamp.
- 2) Remove the regulator cover and the diaphragm.

3) Adjustment knob removal is started by unscrewing the adjustment knob until it stops.

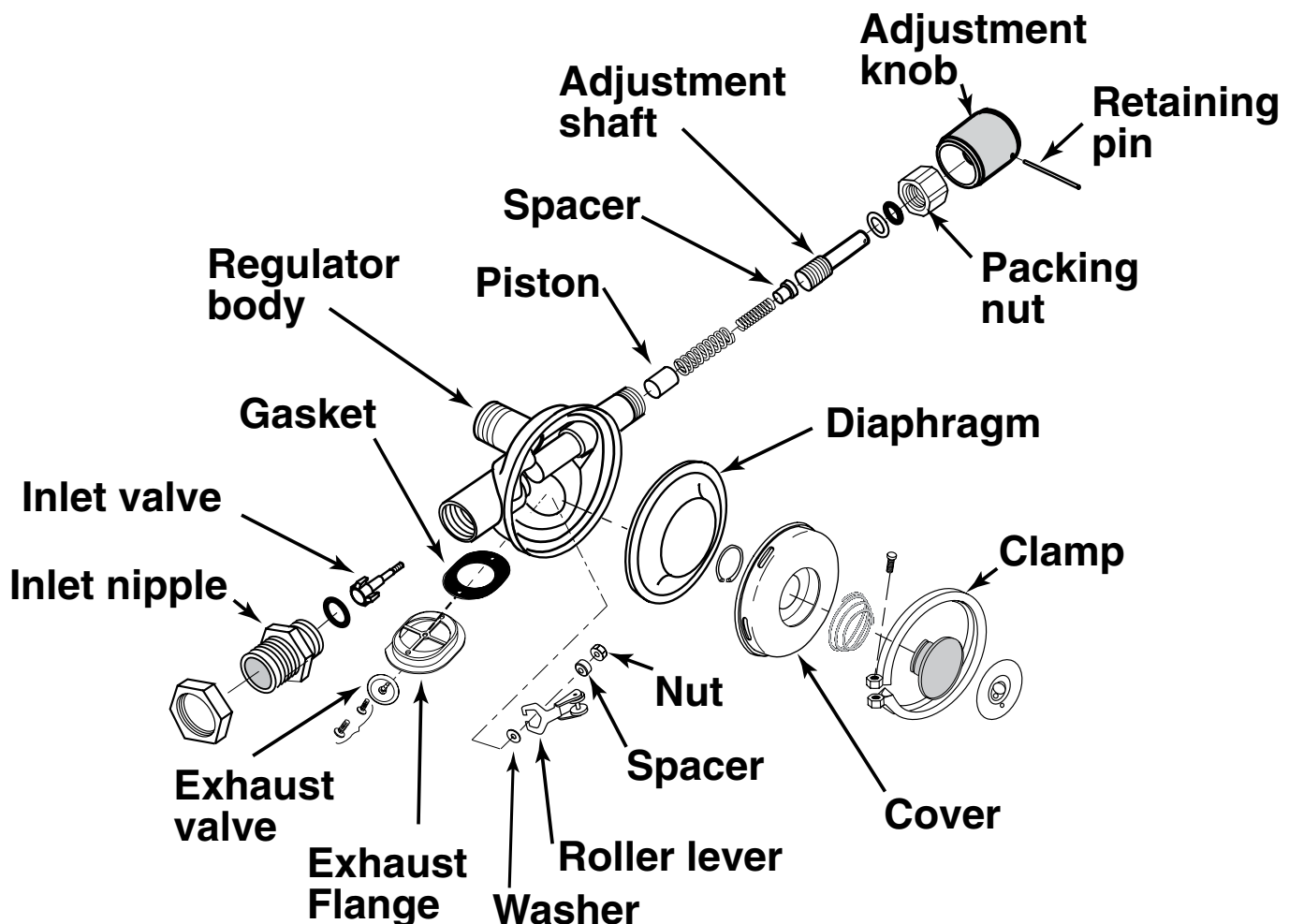
4) The packing nut is now exposed enough to use a wrench on it for removal. As the nut is backed off, unscrew the knob also.

5) The O-ring and washer will remain on the adjustment shaft.

6) Tilt the helmet so that the spacer, spring set, and piston fall out of the adjustment tube of the regulator.

NOTE: If the spacer and the spring set are stuck, this indicates possible corrosion or saltwater intrusion into the adjustment tube or the adjustment tube may be bent. The demand regulator requires removal from the helmet and cleaning per this Chapter and This occurs if the helmet were dropped on the adjustment knob or the diver hit the adjustment knob against a rigid object. Repairs must be made by a trained KMDSI technician.

7) On the adjustment knob, drive out the roll pin using a 3/32 punch. Use a block of wood with a 1/4 " hole



The SuperFlow 350 regulator assembly.

drilled through it to support the knob. Position the knob so the roll pin is over the hole. The adjustment knob can be held against the wood block allowing the roll pin to be driven into the 1/4 " hole.

8) Remove the inlet nipple from the regulator body. The O-ring should be replaced if a scheduled overhaul is being performed.

9) Place the castle wrench in the inlet nipple side of the demand regulator over the soft seat of the inlet valve to prevent the inlet valve from rotating.

Install the socket wrench from the KMDSI Tool Kit (Part #525-620) through the adjustment tube and engage the adjustment nut on the inlet valve. Loosen and remove the adjustment nut by rotating the socket wrench counterclockwise.



The Castle Wrench and inlet valve.

10) Tilt the regulator and drop out the inlet valve and washer.

11) The spacer and lever will now fall out of the regulator body.

NOTE: Ensure that the washer comes out with the rest of the components.

12) Remove the screws that hold the exhaust flange in position. Remove the flange and gasket from the regulator body.

13) Remove the exhaust valve from the exhaust flange.



CAUTION

The inlet valve adjustment nut must never be reused. Reuse of the adjustment nut will not allow the regulator to maintain proper adjustment.

7.7.8 Inspection of SuperFlow 350 Demand Regulator Parts

After the regulator has been disassembled, clean and inspect all parts. Any parts showing signs of wear, damage or deterioration should be replaced. If this is an annual overhaul KMDSI recommends replacement of the inlet valve seat, adjustment nut, O-ring on inlet valve, O-ring on adjustment shaft, washer on the adjustment shaft. A rebuild kit is available for replacement parts (Part #525-309).

If any parts show any signs of damage, deterioration or any damaged threads, the part should be replaced. The adjustment nut must never be reused. Reuse of the adjustment nut will not allow the regulator to maintain proper adjustment.

1) Exhaust valve: Ensure the silicone exhaust valve shows no signs of damage, brittleness or any deformities. The exhaust valve should lay flat against the seat. If conducting an Annual Overhaul, the exhaust should be replaced. Ensure the seat spokes that hold the exhaust valve are smooth, even and not bent.

Slight bends in the spokes may be removed by pressing with a thumb. The exhaust valve seating area should be free of dirt and corrosion to ensure the valve can lay flat and seal properly. NEVER lubricate the valve. Lubricating the valve can allow dirt to stick to the seat causing poor performance and wet breathing.



The exhaust valve must be in good condition.

2) Inlet valve: Check the condition of the rubber seat for wear and/or deep grooves. If the red silicone seat surface is stained to a dark color, this is an indication that the air supply being used was dirty,

Check the condition of the inlet nipple. The inlet nipple knife-edge must be in good condition, free of nicks, chipped chrome or any damage. If the inlet

nipple knife-edge has nicks or missing chrome, the inlet nipple as well as the soft seat will require replacement. During annual overhaul the inlet valve soft seat should be replaced.

3) Inlet Valve Soft Seat Replacement: To replace the soft seat use a small screwdriver or O-ring pick to pry the soft seat from the chrome plated brass valve body. Using a sewing needle clean all old silicone sealant from the vent hole in the bottom of the cup area, and from the cupped area itself. Note: Replace the entire inlet valve if any chrome is missing or if the shaft is bent or thread damage is present.

4) Dab a small amount of silicone adhesive Dow Corning 732 or equivalent on one side of the new soft seat then press the seat into the cup area of the inlet valve assembly then using a clean cloth, wipe all excess silicone from the valve assembly.

WARNING

Use silicone sealant in a well ventilated area. Do not breathe the fumes from uncured silicone sealant. These fumes are dangerous and can cause unconsciousness. They can also cause long term damage to body tissue. Read and follow all precautions listed on the silicone sealant tube and Material Safety Data Sheet.

5) Diaphragm: Check to determine if rubber has separated from the metal disc. Hold the diaphragm to a bright white light, while aggressively pulling and stretching to reveal damage, deterioration, or holes.

Diaphragms showing any indication of damage should be replaced. The diaphragm should always be replaced during scheduled annual overhauls.

6) Inspect the whisker. Replace the whisker if it shows signs of wear, aging or any damage.

The new whiskers used in the Quad Valve™ are much more rugged than the older latex double exhaust system and will give a much longer service life and provide better breathing performance at depth. Older latex double exhaust systems should be replaced with the new Quad Valve™ exhaust system.

7.7.9 Reassembly of the SuperFlow 350 Demand Regulator

NOTE: Use the blow-apart in the back of the manual to help ensure correct assembly.

- 1) Install the exhaust flange, gasket, and screws onto the regulator body. Use Loctite 222 to secure the screws. Tighten the screws to 6 inch pounds.
- 2) Trim off any excess material from the gasket that might interfere with the operation of the exhaust valve.
- 3) Install the new exhaust valve into the regulator and trim off any excess stem that may interfere with the movement of the lever or inlet valve.



The screws that hold the flange on the regulator body should be tightened to six inch pounds.



The gasket must be installed between the flange and regulator body.



If the flange is tightened too much, the gasket will protrude into the exhaust valve opening and interfere with proper regulator performance.



Be sure to use Loctite to install the screws in the regulator body.



The exhaust valve is installed on the outside of the flange.



The "tail" of the exhaust valve that sticks into the regulator body must be trimmed.

4) While using the castle wrench to hold the inlet valve, insert the valve into the bent tube end of the regulator body. First place the washer, then the spacer over the end of the inlet valve stem. As an alternate procedure, the washer and spacer may be placed in the recess in the inside of the regulator body before inserting the inlet valve stem.

5) Using the nut driver from the tool kit, run the nut onto the inlet valve stem approximately 1 1/2 to 2 turns, leaving enough slack to allow installation of the lever. With the inlet valve pressed in, the washer and spacer must be loose on the inlet valve stem so the lever can be installed.

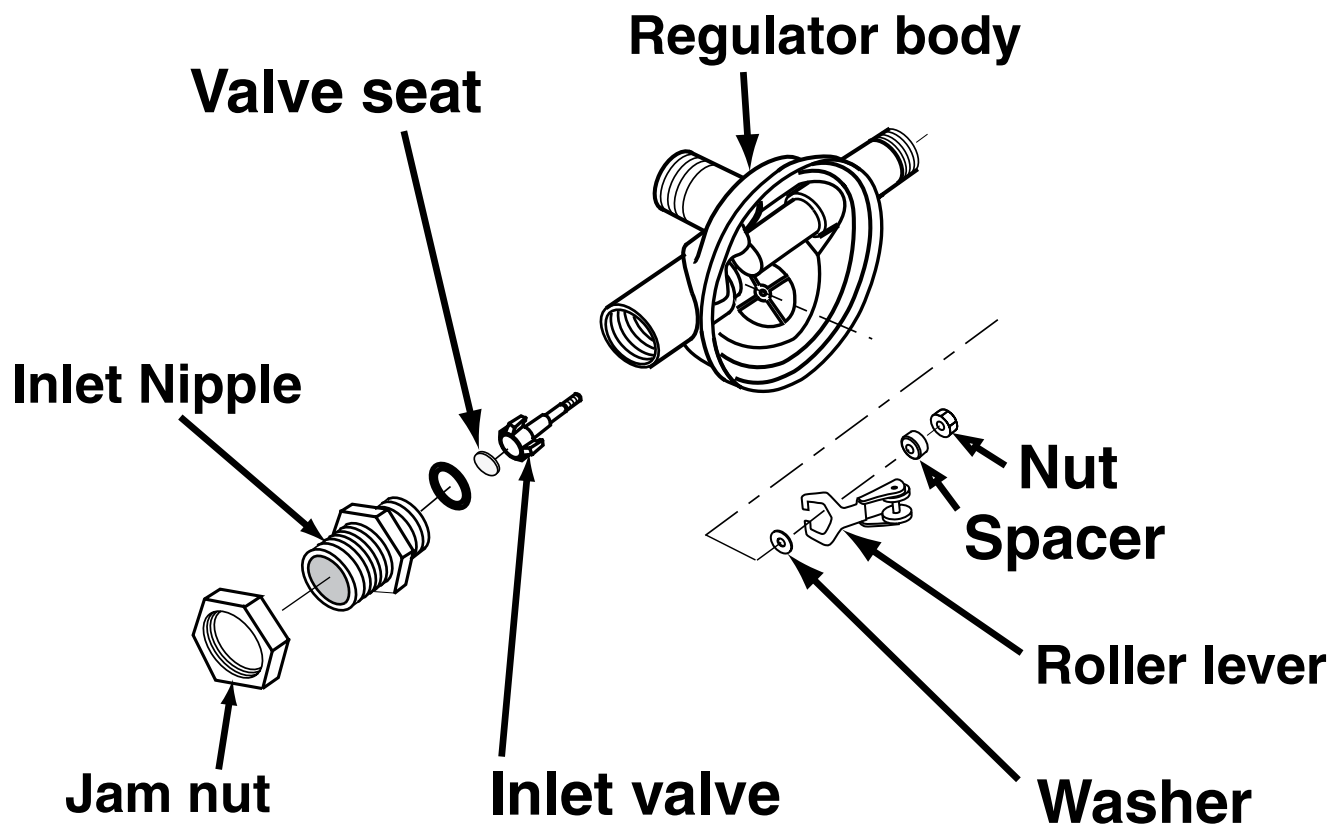
6) Check the roller lever. The lever legs MUST be parallel to each other and free of any nicks or burrs. Check them with a straight edge and align them if necessary by carefully bending them with pliers.

7) Hold the inlet valve with the castle wrench so that it cannot rotate, tighten the nut until three threads are visible past the nut. This will be close enough for initial set up.



CAUTION

Be sure that the washer and spacer that are installed on the inlet valve shaft are installed in the correct order. If they are not, the regulator will not perform properly.



SuperFlow 350 regulator body with roller lever assembly and inlet valve.

8) While holding the lever down, install the inlet nipple with its O-ring into the regulator body. Using the torque wrench, tighten the inlet nipple to 40 inch pounds.

9) Lightly lubricate the piston and spacer. Install the piston, spring set and spacer into the adjustment tube of the regulator body, as shown in the blow-apart drawing.

10) Lightly lubricate the new O-ring then install the new washer and O-ring on the adjustment shaft.

11) Slide the packing nut onto the adjustment shaft, then slip the knob onto the end of the shaft. Hold the shaft and rotate the knob until the pinholes line up. Use the inlet valve holder - the "L" shaped tool (or a 3/32" punch), from the regulator tool kit to accurately align these holes.

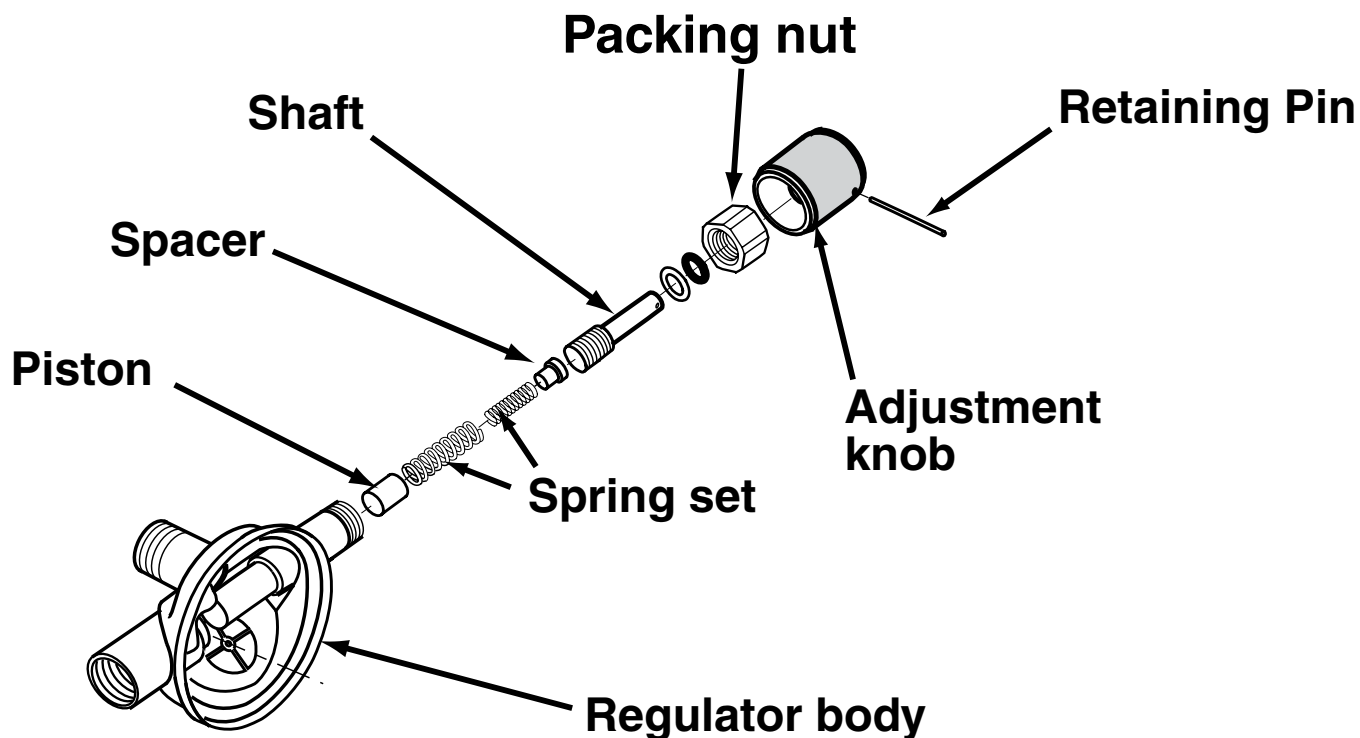
12) Install the retaining pin by tapping it in with a small hammer until it is flush with the outer surface of the knob.

13) Lightly lubricate the end of the shaft and the threads with the appropriate lubricant, and then thread the adjustment shaft clockwise, using the adjustment knob, into the regulator tube until the packing nut can be started.



Install the retaining pin in the adjustment knob.

Back out the adjustment knob once the packing nut is engaged on the demand regulator body to access the packing nut with the torque wrench. Using a torque wrench, tighten the packing nut to 40 inch pounds.



Adjustment end of the SuperFlow 350 regulator.

14) Rotate the adjustment knob in i.e., clockwise, several turns, then recheck the torque one more time. Ensure the adjustment shaft rotates smoothly and there is no binding.

15) Stretch the Quad-Valve main exhaust body onto the exhaust flange of the regulator. Rotate as needed so the port and starboard whiskers can be installed.

16) For the old double exhaust or single exhaust, stretch the exhaust whisker onto the exhaust flange of the regulator. Fasten the double exhaust to the regulator with a cable tie and tighten.

17) Mount the regulator to the helmet. Lightly lubricate and install the sealing O-ring and thread on the regulator mount nut.

18) Install the bent tube assembly before tightening the regulator mount nut, finger tight

NOTE: If this maintenance is during an annual overhaul, replace the Teflon ring at the side block end of the bent tube and the O-ring at the demand regulator inlet side of the bent tube.

Lightly lubricate the O-ring on the bent tube assembly. Slide the O-ring end of the bent tube assembly into the regulator inlet nipple until the side block end is aligned with the threads for the bent tube mount nut. Rotating clockwise, thread the large nut on the bent tube assembly onto the inlet nipple 1 to 2 threads.

Ensure that the Teflon® ring is in place and engage the bent tube nut to the side block fully until it is hand tight. You may need to gently rock the regulator body and/or the bent tube to fully engage side block nut.

Next, fully engage (clockwise) the large nut on the bent tube into the regulator inlet until hand tight. This will ensure the nut is bottomed on the shoulder on the bent tube. Do not tighten further.

Loosen the jam nut on the regulator inlet (counter-clockwise), and engage the jam nut fully to the large nut on the bent tube. Using a torque wrench and an 7/8" open end wrench hold the large nut on the regulator end of the bent tube and tighten the jam nut to 40 inch pounds.



The Quad Valve must be properly connected to the regulator and the quad exhaust cover.

19) Ensuring the O-ring is in place, use a torque wrench with a 1 3/8" socket and an extension to tighten the regulator mount nut to 75 inch pounds. Next using a torque wrench with an 11/16" adapter, torque the bent tube nut to the side block to 100 inch pounds.

20) Attach the whisker to each side of the face port retainer using the screws, plates and spacers. Using a torque wrench with a flat blade screwdriver adapter, carefully torque these screws to 12 inch pounds.

21) Connect the Quad exhaust cover to the exhaust body and install the screws on the Quad exhaust

22) Adjust the regulator following instructions in this chapter.

23) Install the diaphragm, cover, clamp and screw. Tighten the screw to 12 inch pounds using a torque screwdriver.

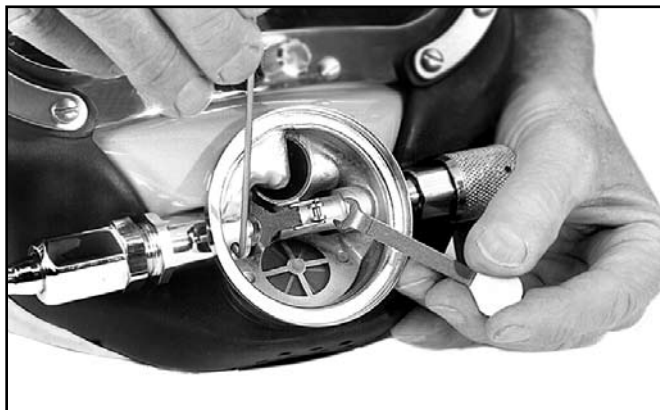
24) Check the regulator for proper operation and fine-tune the adjustment if necessary.

7.7.10 Tuning the SuperFlow 350 Regulator

- 1) Remove the clamp, cover and diaphragm.
- 2) Screw the adjustment knob (clockwise) all the way in, towards the regulator body.
- 3) Pressurize the regulator to between 120-150 p.s.i.g. of supply pressure.
- 4) Screw the adjustment knob out (counterclockwise) until the regulator starts to free flow, then screw the adjustment knob in (clockwise) until the free-flow just stops. Depress the lever several times to ensure the free-flow has stopped.

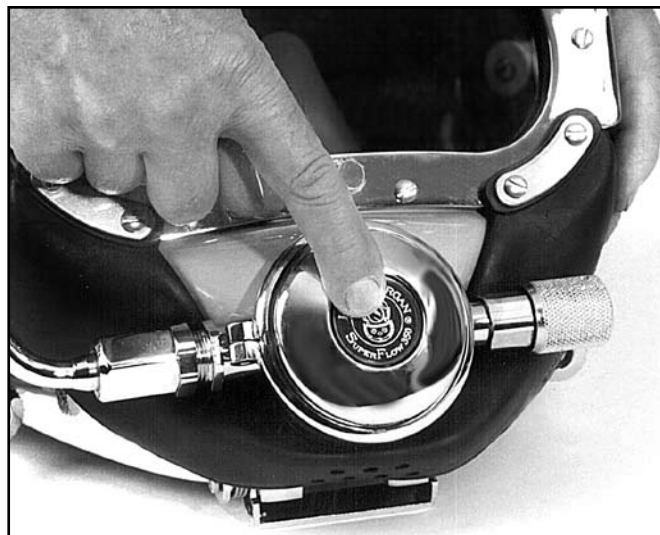
If the free flow does not stop, the adjustment nut is too tight. If the roller lever is sloppy (loose) the adjustment nut is too loose.

- 5) Insert the inlet valve holding tool into the balance hole on the inlet tube. Push forward on the tool to stop the inlet valve stem from turning. Adjust the nut until there is 1/16 inch (1.5 mm) to 1/8 inch (3.0 mm) of free play at the end of the lever.



Insert the inlet valve holding tool into the balance hole on the inlet tube.

- 6) Remove the inlet valve holder tool.
- 7) Put the diaphragm and cover in place, depressing the cover tightly to simulate a properly tightened clamp.
- 8) Depress the purge button in the center of the cover.
- 9) There must be 1/16 inch (1.5 mm) to 1/8 inch (3.0 mm) of free travel before the purge button actuates, resulting in a slight flow of gas. If a slight flow of gas develops with the purge button depressed less than 1/16 inch (1.5 mm) the lever will require bending down.



Test the response of the purge button.

If the purge button travels further than a 1/8" (3.0 mm) before gas flow starts, the lever will require bending upward.

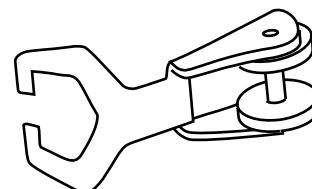
NOTE: Before bending the lever, double-check the adjustments. It is rare that the lever requires bending. Usually levers only require bending because of they were improperly serviced previously, or because of damage during disassembly.

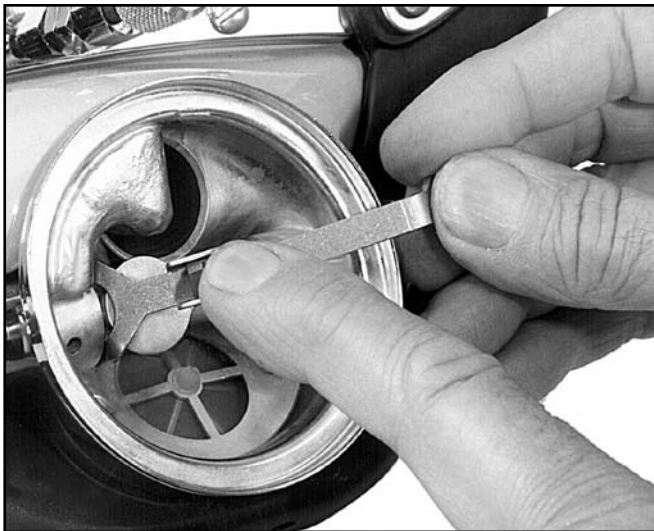
- 10) To bend the lever up, you'll need to remove the lever and carefully place it in a vice. Grip the lever from the side with a pair of long nosed pliers and bend the roller end up with your finger. Bend it only a small amount at a time.

NOTE: Be very careful to not place undue stress on the lower arms of the lever as this will disfigure the lower blades and cause spongy operation.

- 11) To bend the lever down, place the disk end of the KMDSI 1/4" wrench onto the flat area of the adjustment tube within the regulator, sliding the disk as far as possible under the lever. With your finger, slightly bend the lever down over the disk to the desired height. Be careful not to bend the lever too far! Bend it slightly then check it.

Note that the legs of the lever must be properly aligned and in the same plane for the lever to work correctly.





Use the disk end of the KMSI wrench to bend the lever down.



CAUTION

The legs of the lever must be properly aligned in the same plane. If one leg is up and the other is down, the regulator will not perform properly.

12) Replace the diaphragm and the cover. Test the purge button. Continue until proper tolerances are reached.

7.7.11 SuperFlow 350 Regulator Steady Flows When Pressured Up: Special Tools Used

Tools Required:

Small flat blade screw driver.

Small jewelers screw driver or metal scribe.

Needle nose pliers.

KMDSI regulator tool kit if available.

A few words about the demand regulator: The demand regulator is rugged and reliable. However, to maintain optimum performance it should be checked prior to each diving day in accordance with the brief procedure **Demand Regulator Test for Correct Adjustment, Fully Assembled.**

If after completing the demand regulator test as outlined in this chapter, adjustment is necessary and the special KMDSI tool kit is not available proceed as follows:

- 1) Remove the regulator clamp, cover and diaphragm.
- 2) Adjust the regulator adjustment knob all the way in. Finger tight only.
- 3) Pressurize the regulator to between 120-150 p.s.i.g. (8.5-10 bar).
- 4) If the regulator is not free flowing, slowly back out on the adjustment knob until a slight free flow is heard and then rotate the adjustment knob in (clockwise) 1/4 turn and depress the purge button momentarily. Repeat this procedure until the gas flow stops.

Usually at this point the regulator adjustment knob will be between 5 and 7 turns out. ***Note: If when backing the adjustment knob out from the full “in” position, the regulator starts free flowing at less than five turns, then this usually indicates insufficient free play at the lever.***

There are several issues that could cause the regulator to free flow, even when the adjustment knob is turned all the way in. These are as follows:

A) The regulator was rebuilt and the adjustment nut is too tight. If this is the case, the nut must be loosened.

B) The washer was never removed from the regulator and a second one has accidentally been installed. If this is the case, the second washer must be removed.

C) The regulator body has never been properly serviced and there is corrosion inside the body, making proper inlet valve travel impossible.

5) Check the free play at the lever. The lever should have between 1/16-1/8 inch (1.5-3.0 mm) play. If adjustment is necessary, adjust using the KMDSI tools.

6) KMDSI tools: Using the inlet valve holding rod, (L shaped rod), insert the end of the rod into the balance hole. Lightly apply force by pushing on the rod making it act as a lever to put friction against the inlet valve shaft. At this point, the KMDSI wrench can be used to rotate the lever nut. Rotate the nut “In” (clockwise) to reduce lever play or “Out” (counter clockwise) to increase lever play.

Only rotate the nut 1/8 turn at a time. Remove the tools and depress the lever several times after adjusting to ensure the correct play is achieved. It may be necessary to repeat this procedure several times, as the method requires estimating the correct position of the nut. Note: if there is little (less than 1/16 inch / 1.5 mm) or no lever play, the regulator will free flow. If there is too much free play, (more than 1/8 inch / 3.0 mm) the regulator will not be capable of full demand flow potential.



WARNING

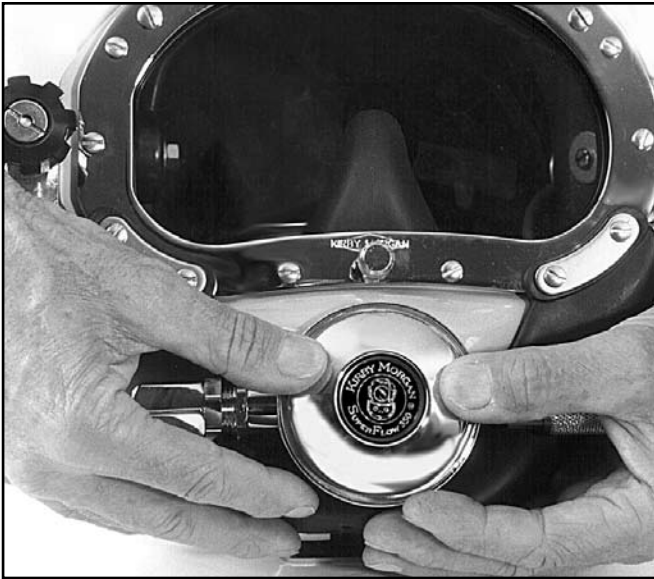
The lock nut must always be replaced if removed from the inlet valve. The plastic material that locks the nut is not designed for multiple reuse. If the nut comes loose during a dive the regulator would free flow heavily. In the situation where the diver is using bottled breathing gas this would result in a rapid consumption of breathing gas.



CAUTION

The nut must not be loosened more than 1/8 turn to lower the height of the lever. If more adjustment is necessary the lever should be bent downward. If the nut is loosened more than 1/8 turn the lever will not have enough travel for proper flow rates.

7) If the free flow did not stop after this procedure, refer to regulator disassembly and cleaning procedures.



Press the cover over the diaphragm.

Alternate method: If a KMDSI tool kit is not available, a small jeweler's screwdriver or metal scribe can be inserted in the slot on the end of the inlet valve to keep it from rotating, and needle nose pliers may be used to rotate the lever nut. Holding the slot of the inlet valve from rotating, carefully rotate the nut "In" (clockwise to remove lever play and "Out" (counterclockwise) to increase lever play.

Only turn the adjustment nut 1/8 turn at a time. Depress the lever momentarily after each adjustment and observe the lever play. It may be necessary to complete this procedure several times, as the procedure requires estimating the proper position of the nut. If the regulator free flow did not stop after this procedure, refer to regulator disassembly and cleaning sections of this manual.

8) When adjustment is complete, place the diaphragm and cover in place, and press tightly down on the cover to simulate the action of the clamp.

9) With the cover pressed tight against the diaphragm, if the regulator starts to free flow, the lever may need to be bent down slightly. If the regulator does not free flow, slowly depress the purge button until a slight free flow develops. The purge button should depress no further than 1/8 inch (3.0 mm) before the regulator develops a flow.

If the regulator does not develop a slight free flow when the purge button is depressed in 1/8 inch (3.0 mm), then the lever will require slight upward bending.

Before bending the lever, double check the adjustments. It is rare that the lever requires bending in

a regulator that has been in service. Usually levers only require bending in new installations or because of damage during disassembly.

10) Install the clamp and clamp screw. Tighten the screw to the correct torque (see appendix for torque specifications).

11) Again, press on the purge button in the cover. It must have 1/16 inch (1.5 mm) minimum and 1/8 inch (3.0 mm) maximum free travel before it contacts the diaphragm. If there is more than 1/8 inch (3.0 mm) travel, the lever must be bent upward, per this chapter. If the button has only slight or no free travel, the lever must be bent down.

12) If the purge button travel is correct, the adjustment is complete.

7.8 Oral/Nasal

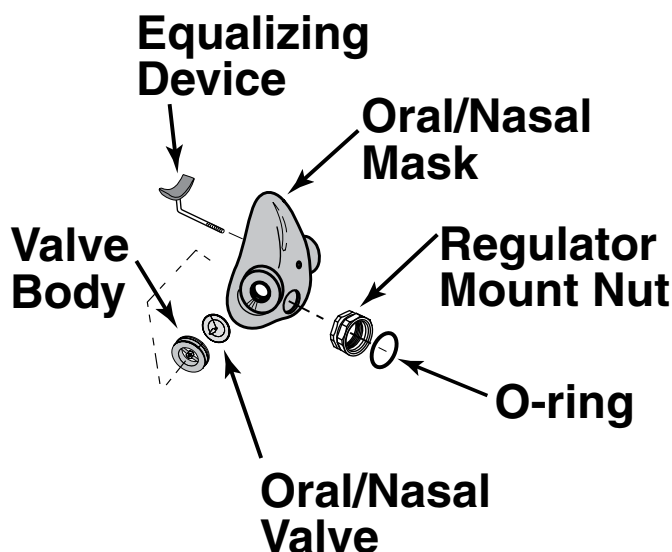
7.8.1 Oral Nasal General Information

The oral/nasal mask is used to control and maintain low carbon dioxide (CO₂) levels in the helmet and to isolate the microphone for more intelligible speech.



WARNING

Never dive with a Kirby Morgan helmet without a properly functioning oral/nasal mask. Without an oral/nasal, dangerous levels of carbon dioxide may accumulate in the helmet. This can lead to unconsciousness and death.



The oral nasal mask and the parts associated with it are easy to access.

7.8.2 Oral/Nasal Removal

Tools Required:

7/16 inch Open-end Wrench

The oral/nasal mask is easily replaced.

- 1) Remove the nose block device first. See chapter 8.
- 2) Remove the microphone.
- 3) The oral/nasal mask can then be pulled off the regulator mount nut. It is held on by a snap fit.



WARNING

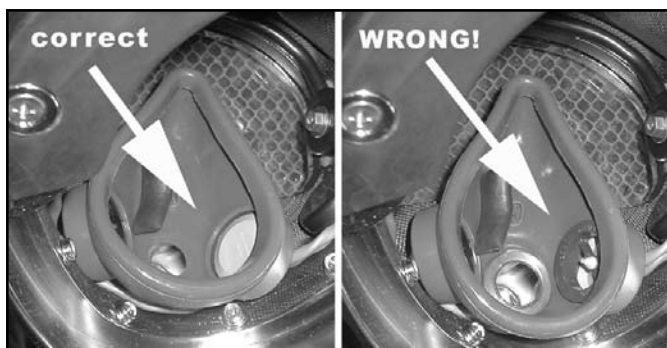
The nose block device MUST be removed and reinstalled when installing a new oral nasal mask. Simply stretching the oral nasal mask over the nose block device can cause the oral nasal mask to tear. Do not use a torn oral/nasal mask. This can lead to dangerous levels of carbon dioxide in the helmet.

7.8.2 Inspection of Oral/Nasal

- 1) Inspect the oral/nasal mask. If it is torn, damaged or aged it must be replaced.
- 2) Inspect the oral/nasal valve. If it is torn or damaged it must be replaced.
- 3) Remove the valve body by pushing it out of the oral nasal.
- 4) Remove the old valve by pulling it out.
- 5) Install the new valve by feeding the thin tail through the valve body and pulling on it until the valve is seated. Cut off the excess "tail."
- 6) Install the valve body in the oral nasal. The valve **MUST** be on the inside of the oral nasal.

7.8.3 Oral/Nasal Replacement

- 1) Snap the oral/nasal over the regulator mount nut (45).
- 2) Reinstall the microphone.
- 3) Reinstall the nose block device.
- 4) Ensure that the oral/nasal valve has been installed correctly.



Correct installation of the oral/nasal valve is extremely important to your safety.



WARNING

The oral/nasal valve must be replaced correctly to provide gas flow in the proper direction. The flow through the valve must be from the interior of the helmet into the oral nasal mask. This will allow the diver to breathe the gas from the defogger valve freely, yet help to reduce carbon dioxide inside the helmet.

If the valve is not replaced properly this could make it difficult to breathe the gas supplied by the defogger and expose the diver to an excess of carbon dioxide. This could lead to exhaustion and blackout resulting in serious injury or death.

7.9 Quad-Valve™ Exhaust Assembly

The Quad-Valve™ exhaust became standard on the Kirby Morgan 37 helmet as of March 2005. This is a superior exhaust system that ties together the regulator exhaust and the helmet exhaust into one unit with exceptionally low exhalation resistance.

The Quad-Valve™ is nearly identical in design to the previously standard Tri-Valve™. The difference between the two units is that the Quad-Valve™ uses the quad exhaust cover to connect the exhaust body to the exhaust main body. All other parts are identical. If you have an older KM37 helmet you are strongly encouraged to upgrade your helmet to the Quad-Valve™ design with the Quad Valve cover.

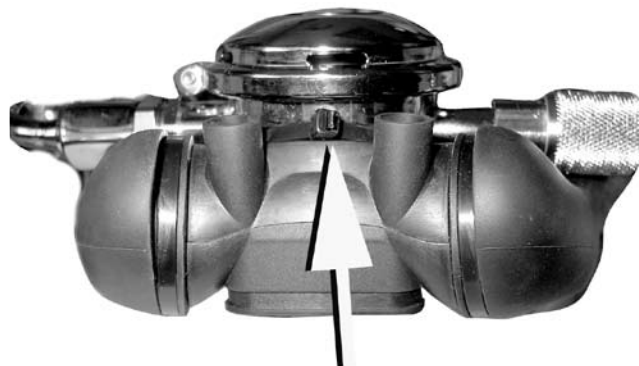
7.9.1 Quad-Valve™ Assembly Removal

Tools Required: Screwdriver

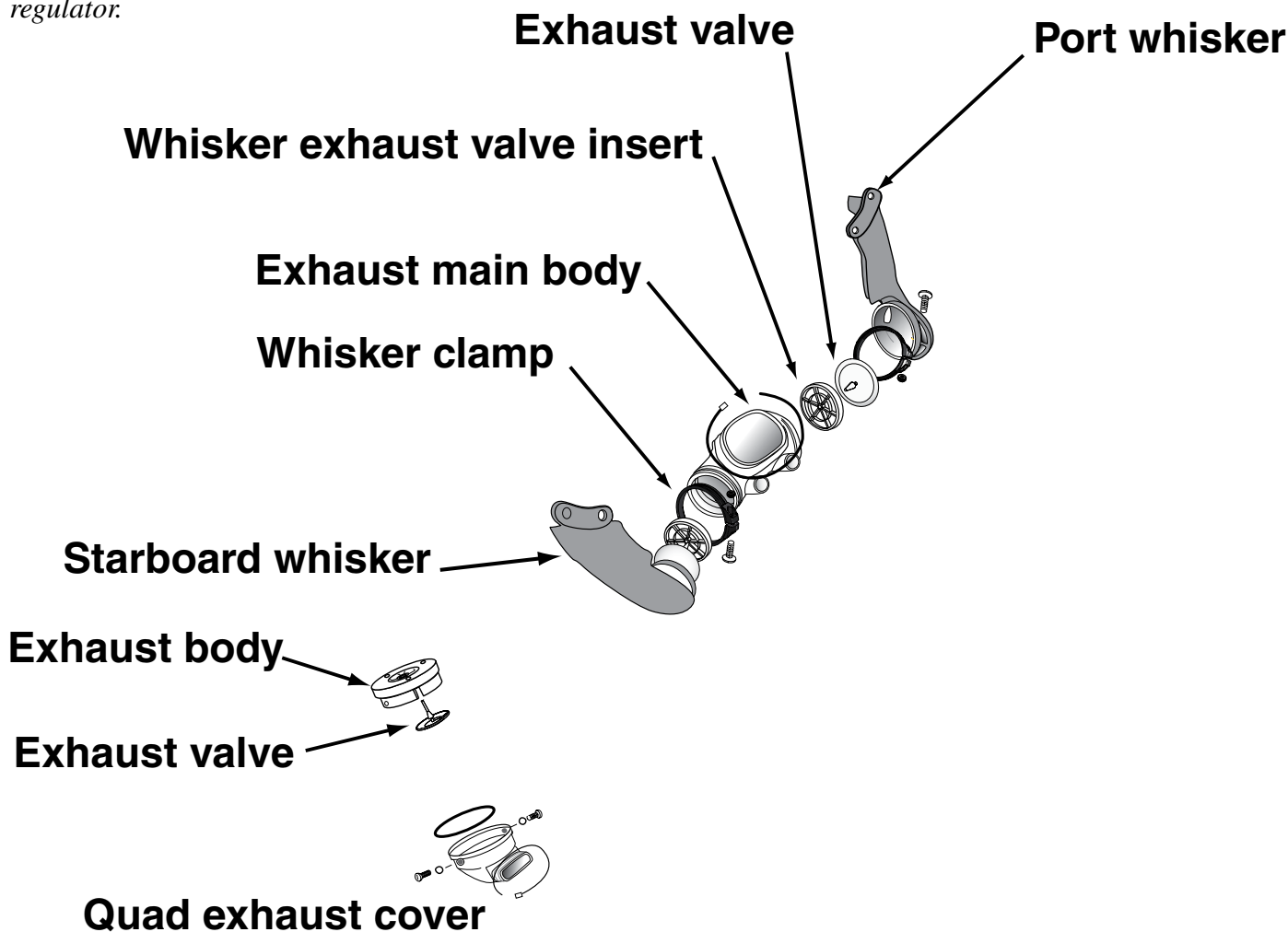
Small cutting pliers

NOTE: It is necessary to first remove the regulator and Quad Valve exhaust assembly from the helmet to separate the Quad-Valve™ Assembly from the regulator.

1) Removal of the Quad-Valve™ Assembly is started by cutting the tie wrap that holds the assembly to the regulator. After removing the tie wrap, stretch the exhaust main body over and off of the regulator exhaust flange.



To remove the Quad-Valve™ exhaust from the helmet you must first cut the tie-wrap that secures the exhaust main body to the regulator.



Exploded view of the Quad-Valve™ exhaust system.

7.9.2 Quad-Valve™ Exhaust Valves

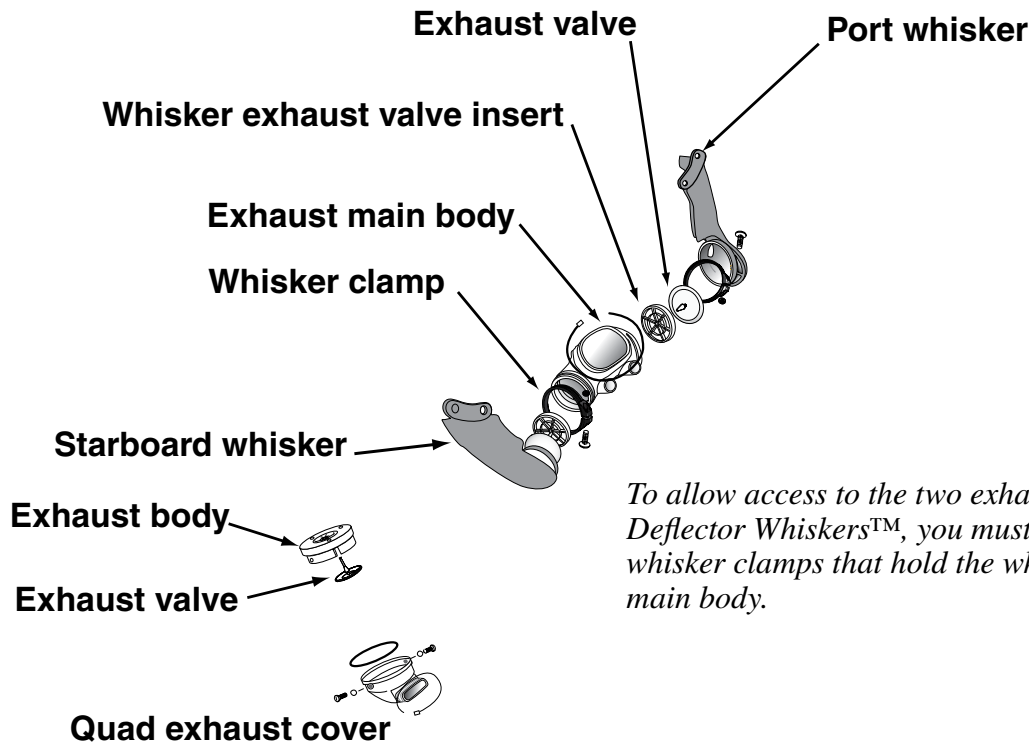
NOTE: It is necessary to first remove the regulator and exhaust assembly from the helmet to replace the exhaust valves.

7.9.2.1 Quad-Valve™ Exhaust Valve Replacement

- 1) Remove the Quad-Valve™ Assembly from the regulator.
- 2) Carefully remove the two whisker clamps that hold the deflector whiskers to the main exhaust body .

NOTE: The exhaust valve and whisker exhaust valve inserts must be placed into the Quad-Valve exhaust main body correctly to provide gas flow in the proper direction. The flow must be from the inside of the Quad-Valve exhaust main body out to starboard whisker and port whisker.

- 5) Install an exhaust valve/whisker exhaust valve insert assembly into both seating areas on each side of the exhaust main body.



To allow access to the two exhaust valves in the Deflector Whiskers™, you must first remove the two whisker clamps that hold the whiskers on the exhaust main body.

- 3) Remove the two exhaust valve inserts and valves. Carefully note which side the valves are installed into and which way they face when mounted in the body. They **MUST** be reinstalled facing the same way. See the illustrations below.

- 4) Install a new exhaust valve into each whisker exhaust valve insert on the correct side by feeding valve tail through hole in center of valve insert and pulling on it until valve is seated.

WARNING

The exhaust valve inserts must be installed in the correct orientation in exhaust main body. If the inserts are installed backwards, the diver will be unable to exhale. This could lead to suffocation and death.



The exhaust valve inserts are recessed on one side to accept the exhaust valves so they sit flush in the inserts. The exhaust valves must be installed properly in the inserts or they will not seal or perform properly.



WARNING

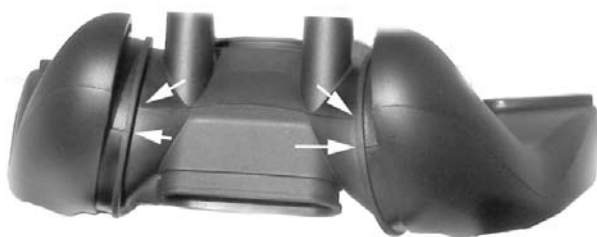
The exhaust valves must be correctly installed in the exhaust valve inserts or they will not seal correctly. This could lead to a backflow of water into the helmet, which could expose the diver to any contaminants that are in the surrounding water. Depending on the contaminants, this could lead to serious personal injury or death.

6) Slide the starboard whisker onto the starboard side of the main body, making sure that you do not dislodge the exhaust valve/whisker exhaust valve insert assembly from its seating area. The parting line on the bottom of the exhaust whiskers should be 5/16" behind the parting line on the main body.

7) Repeat this procedure for the port side.

8) Place whisker clamps around the grooves on each of the two whiskers. Before doing the final tightening of the clamps, make sure that parting line on bottom of wings is 5/16" behind the parting line on the main body, and the clamps are positioned properly on the body.

The correct orientation of the whiskers relative to the exhaust main body are as shown in the photo here. Tighten the screws that hold the clamps until the screws are snug. The threaded ends of the screws should be at least flush with the outer edge of the nut that holds them. Do not overtighten.



The whiskers must be aligned properly on the exhaust main body.

7.9.2.2 SuperFlow 350 Regulator Exhaust Valve Replacement

Before removing the regulator exhaust valve, carefully inspect the area around the edges to assure the rubber exhaust valve is in contact with the regulator body. The metal cross area of the body under the valve could be slightly bent out resulting in the valve not sealing.

If the exhaust valve is high and not sealing, lightly press in on the metal cross, bending the metal in slightly until the rubber valve seats. Remove the existing regulator exhaust valve by pulling it out of its mount hole. If the valve tears, make sure that it is removed without any valve material left inside the regulator.

NOTE: Before installing the new Valve, ensure that the spokes that hold the exhaust Valve are smooth, even and not bent. The Exhaust Valve seating area should be free of dirt and corrosion to insure the valve can lay flat and seal properly. NEVER lubricate the valve.

1. Remove the regulator clamp screw and clamp.
3. Remove the regulator cover and the diaphragm.
4. Install the new regulator exhaust valve by placing the stem of the valve in through the hole in the hub of the spokes from the outside of the regulator. Gently, (using needle nose pliers) from the inside of the regulator, pull the stem of the valve through the hole in the hub of the spokes until it pops into its seating area.
5. Reinstall the diaphragm, regulator cover, clamp and clamp screw.

7.9.3 Quad-Valve™ Assembly Installation

1. The Quad-Valve™ Main Body opening mates to the regulator exhaust flange. This opening needs to be worked onto the flange. Make sure that the Quad-Valve exhaust system is facing the correct direction and is not upside down.
2. Place the tie wrap around the tie wrap groove and tighten, making sure that the tie wrap end is positioned properly. Cut off the excess tie wrap tail.
- 3) Reinstall the regulator/exhaust assembly on the helmet.

7.10 Water Dump Exhaust Body

The water dump exhaust assembly is mounted onto the bottom of the helmet by three screws that are installed on the inside of the helmet shell. RTV silicone sealant is used to seal the water dump body to the helmet shell.

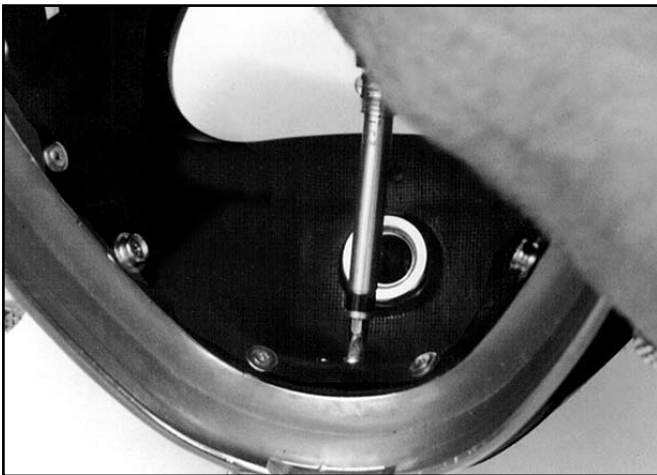
7.10.1 Water Dump Valve Removal

Tools Required:

Flat Blade Screwdriver

1) The Quad Valve cover can be removed by unscrewing the two screws. If the cover is badly dented so that it interferes with the performance of the exhaust valve it should be replaced.

2) The rubber exhaust valve should be replaced at the slightest sign of deterioration or aging of the rubber. Simply grasp the valve and pull to remove.



To remove the exhaust body you must remove the three screws inside the helmet shell.

7.10.2 Water Dump Valve Replacement

1) The rubber exhaust valve is installed by inserting the center stem through the exhaust body then pulling from the inside of the helmet shell until it snaps into place.

2) When installing the quad exhaust cover be sure to never use longer screws that would protrude into the interior of the exhaust body as this would interfere with the operation of the rubber exhaust valve.

7.10.3 Water Dump Valve Body Removal


1) The water dump body should never need servicing. If it is to be removed, you must first remove the three screws inside the helmet shell.

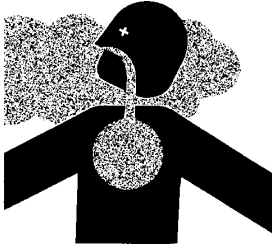
After this is done, gently twist the valve body off of the helmet shell. A putty knife may be used to slide between the valve body and the shell to break the RTV sealant.

7.10.4 Water Dump Valve Body Remounting

1) To replace the main exhaust body, first be sure to clean the helmet and the main exhaust body of the old silicone sealant prior to remounting.

Place a coating of RTV silicone sealant on the mounting surfaces and around the mounting holes, and mate the body to the helmet and start to tighten the mount screws on the interior of the helmet. Wipe off the excess RTV silicone sealant that is squeezed out. Tighten the screws to 12 inch pounds.

**WARNING**



Use silicone sealant in a well ventilated area. Do not breathe the fumes from uncured silicone sealant. These fumes are dangerous and can cause unconsciousness. They can also cause long term damage to body tissue. Read and follow all precautions listed on the silicone sealant tube and Material Safety Data Sheet.

7.11 Reinstalling the Quad-Valve™ Exhaust Assembly

Once the Quad-Valve™ exhaust has been reassembled, it may be mounted back on the helmet.

1) Begin to re-install the demand regulator into the mounting hole in the helmet shell, but insert it only about halfway in. This will allow the stainless steel adapter cover to align easier with the main exhaust body.

Start the cover straight onto the main exhaust body, then alternate back to inserting the regulator. Do this until both are in their proper positions. Lubricate the regulator seal o-ring and hand start the regulator mount nut.

2) Lubricate and install the 2 o-rings and install onto the washer head screws. Using either a flat blade screwdriver or a 1/4 nut driver, fully engage the screws. Tighten until snug. TIP: the 1/4" hex tool found in the Kirby Morgan regulator tool kit works very well for this purpose. (Part #525-620)

3) Reinstall the bent tube assembly and tighten the jam nut to 40 inch pounds.

4) Retighten the regulator mount nut to 75 inch pounds.

5) Reinstall the 4 spacers, kidney plates and screws and torque to 12 inch pounds.

6) Attach any other components that may have been displaced to aid in this installation.



WARNING

Use only KMDSI original replacement spares when repairing your helmet. The use of other manufacturer's parts will interfere with the performance characteristics of your life support equipment and may jeopardize your safety. Additionally, any substitutions will void all warranties offered by KMDSI.



The Quad Valve exhaust cover must be properly fastened to the main helmet exhaust.

7.12 SuperFlow 450 Stainless Balanced Regulator

7.12.1 General

The SuperFlow 450 is another high performance regulator from Kirby Morgan. This is an exceptionally compact, but high performance regulator.



7.12.1 SuperFlow 450 Demand Regulator Test for Correct Adjustment, Fully Assembled

To maintain optimum performance of the demand regulator, it should be checked for proper function and adjustment prior to commencement of diving each diving day, in accordance with the KMDSI Daily Set Up and Functional Checklist. See the Dive Lab website for the latest checklists at www.divelab.com.

Check the regulator for adjustment and proper function with the assembly complete, and supplied with a breathing gas supply pressure of 135 to 150 p.s.i.g.

NOTE: *135 to 150 p.s.i.g. over ambient is the standard supply pressure to be used when adjusting all KMDSI helmets and band-mask equipped with the SuperFlow 450 regulator.*

NOTE: When storing the helmet for any length of time, ensure that the Flex Knob (190) is turned “out” fully counterclockwise to avoid stressing the bias springs. This will prolong the life of both the inlet valve, seat, and bias spring.

1) Rotate the Flex Knob in, towards the regulator body, until a clicking can be heard with each revolution of the knob. This is an audible indication the adjustment spring tension is as tight as it will get. The adjustment knob will never bottom out or stop turning in this direction, so listen carefully for this indicating click.

2) Ensure the supply pressure is connected and properly adjusted to 135 to 150 p.s.i.g.

3) Turn on the gas supply.

4) Rotate the Flex Knob out counterclockwise slowly, three full turns.

5) Lightly depress the purge button several times and ensure the gas flow is stable.

6) Push in gently on the cover of the regulator. There should be 1/4” free travel in the button before gas flow starts. When the button is fully depressed, a strong surge of gas must be heard.

7) If the purge button travels less than 1/4 inch or greater than 1/4 inch before free flow is heard, the demand regulator requires internal adjustment, per this chapter.

7.12.2 Adjusting the SuperFlow 450

Tools required:

Flat blade screwdriver

11/16 inch Open-end Attachment on Torque Wrench

7/8 inch Open-end Attachment on Torque Wrench

7/8 inch Open-end Wrench

1 inch Open End Wrench

1/4" to 5/16" Dowel Rod sharpened by pencil sharpener



Remove the bent tube and the bent tube adapter.

1) Remove the bent tube assembly from the helmet, per this chapter.

2) Remove the bent tube adapter.

3) Insert a flat head screwdriver into slot in the end of the adjustment nipple.



Turn the adjustment nipple 1/16 of a turn at a time to adjust the performance of the regulator.

4) If the regulator did not free flow when the regulator cover was pushed in, turn the adjustment nipple **OUT** 1/16 of a turn. Only small adjustments are needed to tune the regulator. Reconnect the low pressure hose, pressurize it and test again.

5) If the regulator began to free flow too easily, turn the adjustment nipple **IN** 1/16 of a turn. Only small adjustments are needed to tune the regulator. Reconnect the low pressure hose, pressurize it and test again.



Before you reinstall the bent tube, connect the low pressure hose to the regulator and pressurize it again. Push in on the regulator cover 1/4 inch. The regulator should just begin to free flow if it is properly adjusted.

6) If you are unable to obtain a proper adjustment with the regulator following this procedure, you will need to disassemble the regulator to check the condition of the lever.

7) Once the regulator is properly adjusted, reinstall the bent tube adapter and o-ring. Tighten the adapter to 30 inch pounds.

8) Reinstall the bent tube assembly as per Section this chapter.

7.12.3 SuperFlow 450 Demand Regulator Bias Adjustment Field Service with Demand Regulator on Helmet

It is not necessary to remove the regulator from the helmet to perform field maintenance.

Tools Required:

1/4 inch Flat Blade Screwdriver on Torque Wrench

1" Open End Attachment on Torque Wrench

1/4" to 5/16" dowel rod sharpened by pencil sharpener.



Remove the screws and washers on either side of the cover.



Unscrew the cover retaining ring and remove the cover.



Remove the diaphragm and inspect it carefully. If it is torn or punctured it must be replaced.



The lock clip must be removed to service the internal o-rings in the regulator.

- 1) Remove the bent tube assembly from the helmet, per this chapter.
- 2) Remove the screws and washers on either side of the regulator cover.
- 2) Unscrew the cover retaining ring.
- 3) Remove the cover and diaphragm. Inspect the diaphragm for holes or tears. If it is torn or punctured it must be replaced. Inspect the interior of the regulator for foreign matter and remove if necessary.
- 4) Carefully insert the tip of a flat blade screwdriver in the slot at the top of the lock clip to loosen it and slide the clip away from the regulator main tube.



You must hold the lever down to remove all main components as a sub assembly.

5) Using the 1" open end wrench, loosen the packing nut about 1 turn. While depressing the lever arm, grasp the flex knob and pull it straight away from the regulator body. This will remove all of the main components of the regulator valve mechanism as a single, easy to handle unit.

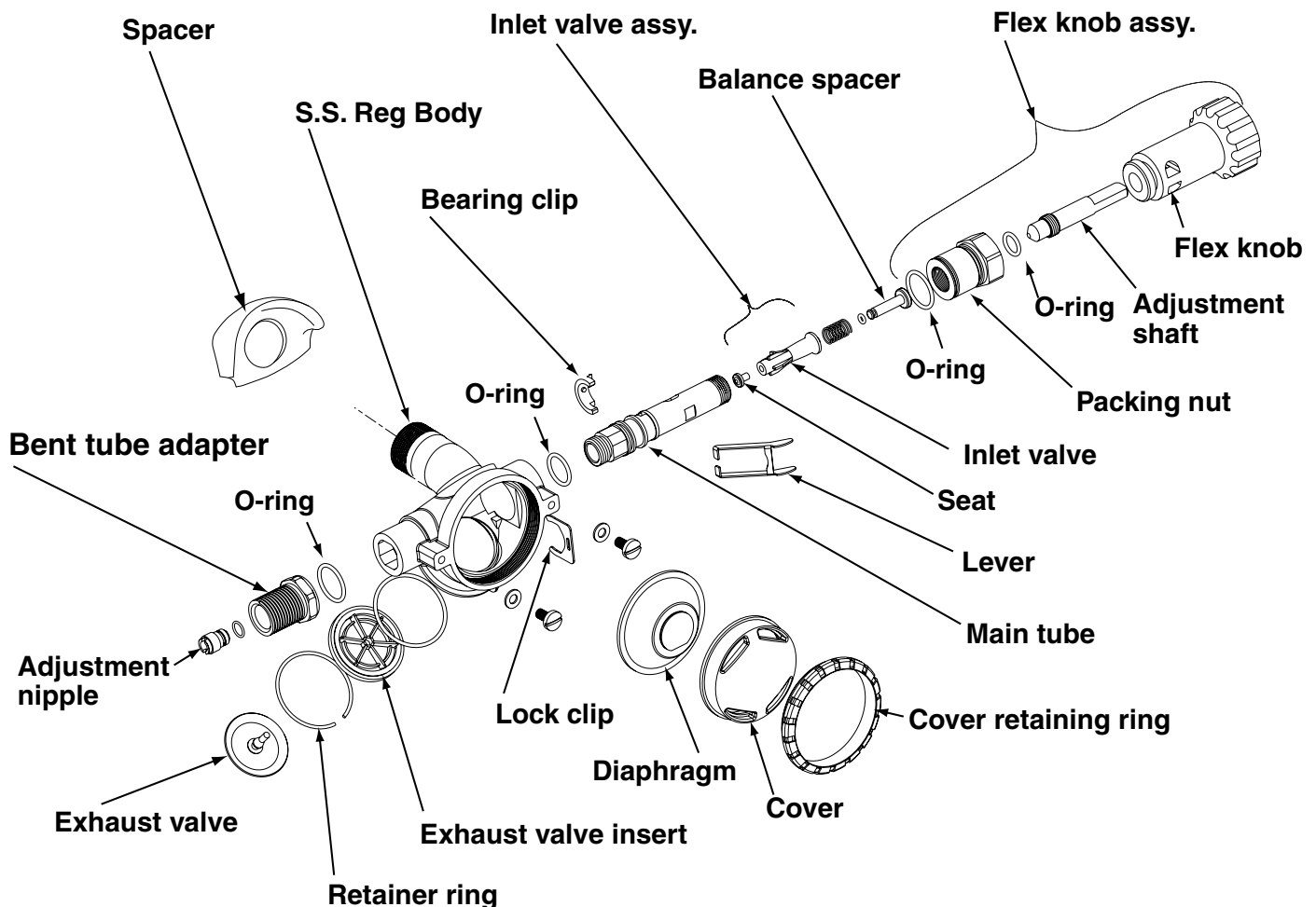
6) Using a 7/8" wrench, remove the bent tube adapter and o-ring.

7) Unscrew the flex knob assembly from the main tube.

8) Remove the o-ring from the flex knob assembly packing nut. Inspect for sign of wear and replace if necessary. Otherwise, if it is in good condition, set it aside for cleaning and lubrication.

9) Remove the lever by gently pulling one leg out from the slot on the main tube, followed by the second leg.

10) Remove the bearing clip from the main tube .



Exploded view of SuperFlow 450 regulator.



When you pull the flex knob assembly out, the main tube and related parts will follow.



Separate the flex knob assembly from the main tube.



Remove the o-ring from the flex knob packing nut. You can use a credit card, toothpick, or any soft device that will not damage the o-ring or the nut.



Remove the balance spacer, spring, inlet valve and seat from the main tube.

11) Slide the balance spacer, spring, inlet valve assembly out from the main tube.

12) Unscrew the adjustment nipple (turn it “out”) from the main tube. This may require lightly tapping on the tube to dislodge the parts.

13) Inspect all parts for signs of wear or damage and replace if necessary.

14) Clean all parts per chapter 6. Lubricate o-rings and moving parts with a light coating of Christo-Lube®. It is not necessary to disassemble the flex knob assembly unless the knob is not working properly. If this is required, refer to Section

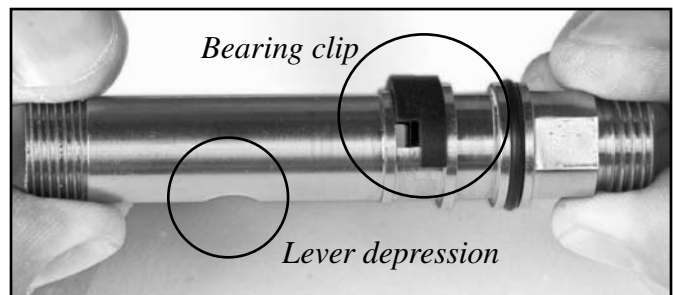
15) Install the o-ring on the adjustment nipple if you have not already done so. Be sure that the o-ring has been properly lubricated with Christolube.

16) Install the o-ring on the main tube.

17) Install the o-ring on the balance spacer.

18) Install the bearing clip on the outside of the main tube. Note that there is a locating pin on the clip that must engage the correct hole on the main tube.

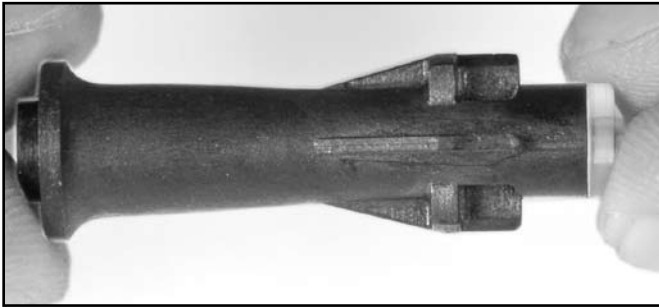
The clip is correctly positioned when it is on the side opposite of the depression for the lever on the main



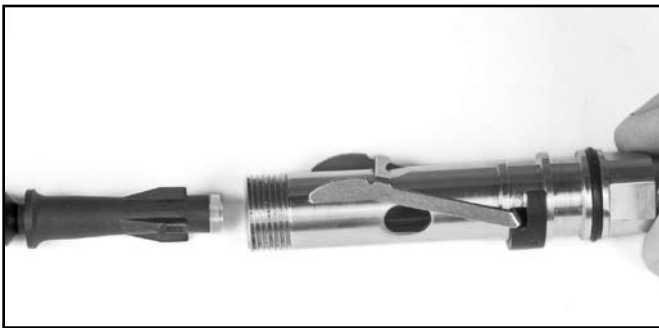
Correct position of bearing clip on main tube.

tube. The square opening on the main tube must be exposed.

19) Spread the arms of the lever just enough to install it on the main tube.



Close-up detail of the inlet valve.



Inserting the inlet valve into the main tube.

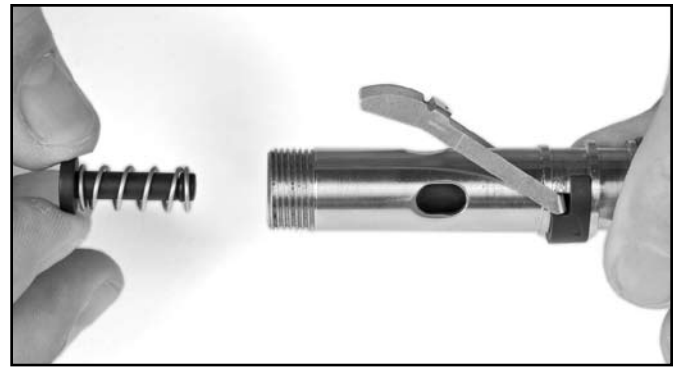
20) Study the features of the inlet valve assembly. There are 4 “wings” towards one end of the assembly and a bore that creates the balance chamber on the opposite end.

The wings that align with the lever arm are the 2 that have an additional wall for the lever arm to bear on. The valve assembly should be inserted into the main tube with these walls toward the bottom of the regulator tube.

21) Using a clean wooden dowel rod, that has been sharpened in a pencil sharpener and inserted in the open end of the inlet valve, properly align and insert the inlet valve into the main tube. If this is done properly, the lever should lift up. If it does not, the valve has not been inserted correctly.

22) While holding the inlet valve in position, pull each arm of the lever outward just slightly until the inlet valve moves further into the main tube, approximately 1/4 inch. The dowel rod should move in a bit further to indicate that this has happened.

23) Release your pressure on the dowel rod. The lever should fall back to its normal position against the main tube. Push in gently on the dowel and the lever



Insert the balance spacer and spring in the main tube. When it is properly installed the spacer will engage the inlet valve.



Thread the adjustment knob onto the main tube.



Thread the adjustment nipple into the main tube.

should rise again to approximately a 45 degree angle. If this does not happen, or the angle is very low, the inlet valve will need to be removed and reinstalled to achieve the correct orientation.

24) Remove the dowel rod and insert the spring and balance spacer with o-ring into the main tube. Make sure the balance spacer is properly aligned inside the main tube by pushing in on the end of the spacer to see that it move inward (i.e., it engages the hole in the inlet valve).

25) Thread the flex knob assembly onto the end of the main tube (closest to the lever arms) until it just stops. Hand tighten the assembly and then back the assembly out one turn.

26) Inert the adjustment nipple into the main tube on the end opposite end from the adjustment knob. Using a flat blade screwdriver, thread the nipple into the tube slowly.

As soon as you see any movement of the lever stop screwing the nipple in. Turn in on the flex knob until an audible click is heard.

27) It is recommended that the regulator sit for 24 hours before any further assembly is completed. This will allow the seat to conform itself correctly to the inlet nipple.

28) Bend the lever down and carefully install this assembly of the main tube and adjustment knob into the regulator until the threaded end of this assembly comes completely through the opposite side of the regulator body.

29) Install the o-ring and the bent tube adapter and tighten to 30 inch pounds.

30) Tighten the packing nut at the flex knob with a one inch wrench to 30 inch pounds.

31) Install the lock clip on the main tube.

32) Adjust the regulator per this chapter.

33) Reinstall the diaphragm, cover and cover retaining ring.

34) Reinstall the bent tube assembly as per this chapter.

35) Once the regulator is properly adjusted, reinstall the washers and screws that secure the regulator cover and ring. Tighten the screws to 12 inch pounds.



Install the o-ring in the bent tube adapter.

7.12.4 SuperFlow 450 Regulator Removal

Required Tools:

11/16 inch Open-end Attachment on Torque Wrench

7/8 inch Open-end Wrench, Torque Wrench and 1 3/8 inch Socket

1 /4 inch Flat Blade Attachment on Torque Screw-driver

- 1) Remove the bent tube assembly, per this chapter.
- 2) Remove the screws, kidney plates and whisker spacers from the whiskers.



Be sure to remove and set aside the whisker spacers.

- 3) Remove the nose block device per chapter 8.
- 4) Remove the oral nasal mask per this chapter.
- 5) The regulator mount nut is removed along with the sealing O-ring.
- 6) Cut the tie wrap that connects the regulator body to the Quad Valve cover.
- 7) Now the regulator assembly can be pulled out of the helmet.
- 8) The center section of the exhaust whisker, named the exhaust main body has a tie wrap holding it in place. Remove the tie wrap then stretch the body off the regulator exhaust flange.



Remove the regulator from the helmet.



Separate the regulator from the Quad valve exhaust whiskers.

7.12.5 SuperFlow 450 Disassembly

Required Tools:

- 1" Open end attachment on torque wrench
- 1/4 inch Flat Blade Attachment on Torque Screwdriver
- 3/8" Dowel Rod

1) Remove the screws and washers on either side of the regulator cover.



Remove the cover retaining ring and regulator cover.



Remove the lock clip from the interior of the regulator.



Unscrew the packing nut from the regulator body.

2) Unscrew the cover retaining ring.

3) Remove the cover and diaphragm. Inspect the diaphragm for holes or tears. If it torn or punctured it must be replaced. Inspect the interior of the regulator for foreign matter and remove if necessary.

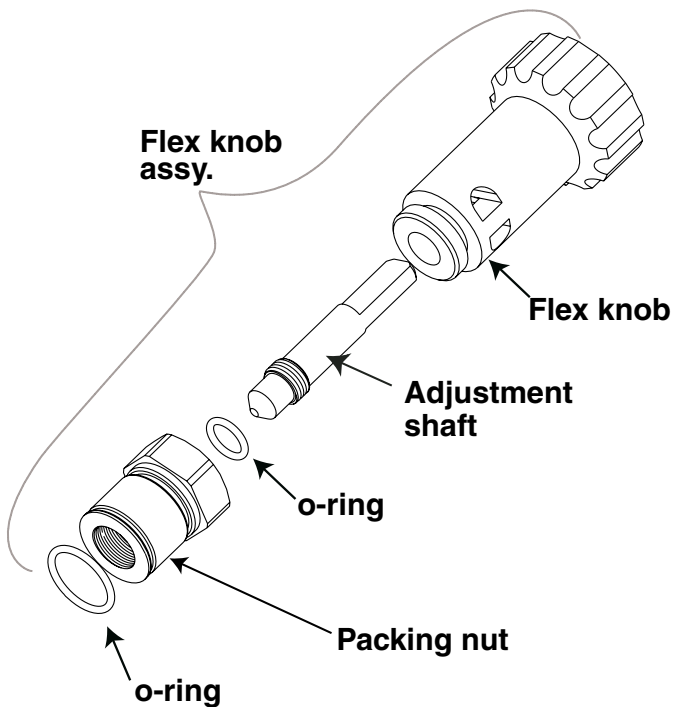
4) Carefully insert the tip of a flat blade screwdriver in the slot at the top of the lock clip and slide the clip away from the regulator main tube.

5) Using the 1" open end wrench, loosen the packing nut about 1 turn. While depressing the lever arm, grasp the flex knob and pull it straight away from the regulator body. This will remove all of the main components of the regulator valve mechanism as a single, easy to handle unit.

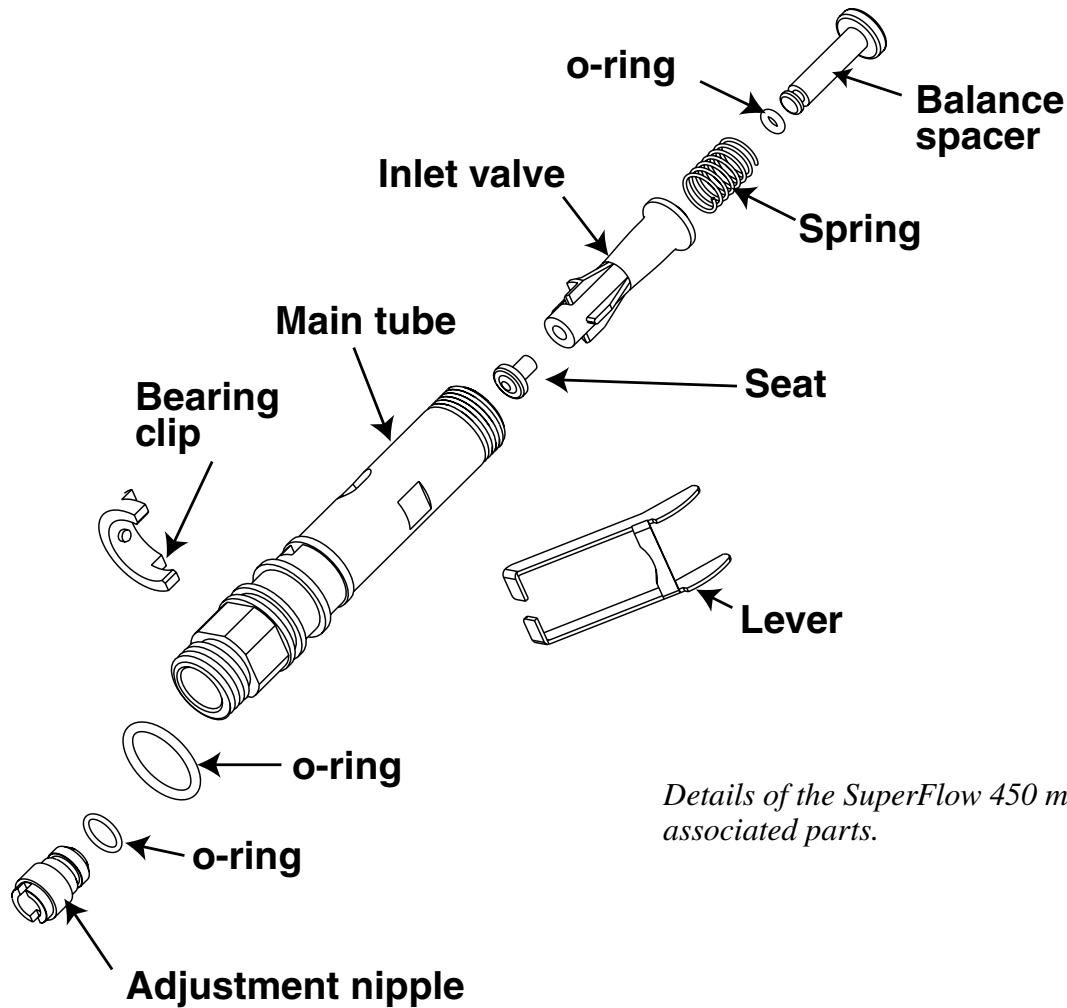
6) Unscrew the flex knob assembly from the main tube.

7) Loosen the packing nut on the flex knob and unscrew the packing nut. Hold the packing nut while turning the flex knob clockwise. You will notice the internal adjustment shaft will travel outward AWAY from the packing nut.

This shaft may not fall out so after about 10 revolutions of the knob. It will be possible to grab the chamfered tip of the shaft and pull it straight out from the assembly.



SuperFlow 450 flex knob assembly.



Details of the SuperFlow 450 main tube and associated parts.

8) Remove the adjustment shaft from the flex knob. With the shaft out, grab the packing nut with one hand and the flex knob with the other and bend. There is a boss on the knob that will pop loose from the packing nut.

9) Remove the o-rings from the adjustment shaft and packing nut.

10) Remove the lever by gently pulling one leg out from the slot on the main tube, followed by the second leg.

9) Remove the bearing clip from the main tube.

10) Slide the balance spacer, spring, inlet valve assembly out from the main tube.

11) Unscrew the adjustment nipple from the main tube.

12) Remove the o-ring from the balance spacer.

13) Remove the o-ring from the main tube.

14) Unscrew the adjustment nipple from inside the

main tube and remove the o-ring from the nipple.

15) Remove the retainer ring from the regulator body.

16) Remove the exhaust valve insert from the regulator body and separate the exhaust valve from the insert.

17) Inspect all parts for signs of wear or damage and replace if necessary.

18) Clean all parts per chapter 6. Lubricate o-rings and moving parts with a light coating of Christo-Lube®.

7.12.6 Assembly of the SuperFlow 450 Regulator

Required Tools:

11/16 inch Open-end Attachment on Torque Wrench

7/8 inch Open-end Wrench, Torque Wrench and 1 3/8 inch Socket

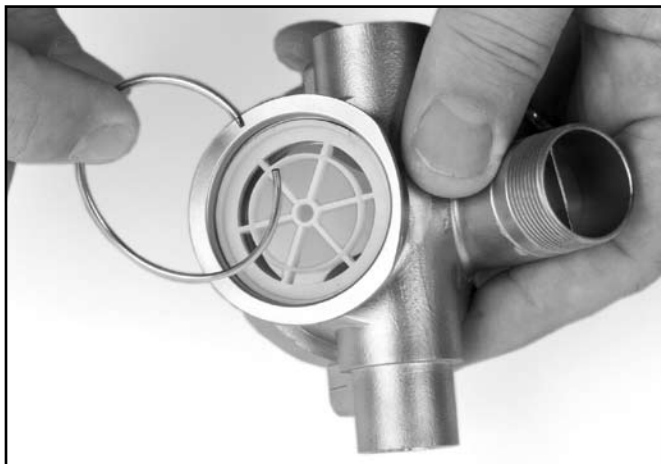
1 /4 inch Flat Blade Attachment on Torque Screw-driver



The regulator body must be clean and free of foreign matter.



Install the o-ring and valve insert.



Install the retainer clip.

1) Inspect the interior of the regulator body and make sure that it is clean and there is no foreign matter.

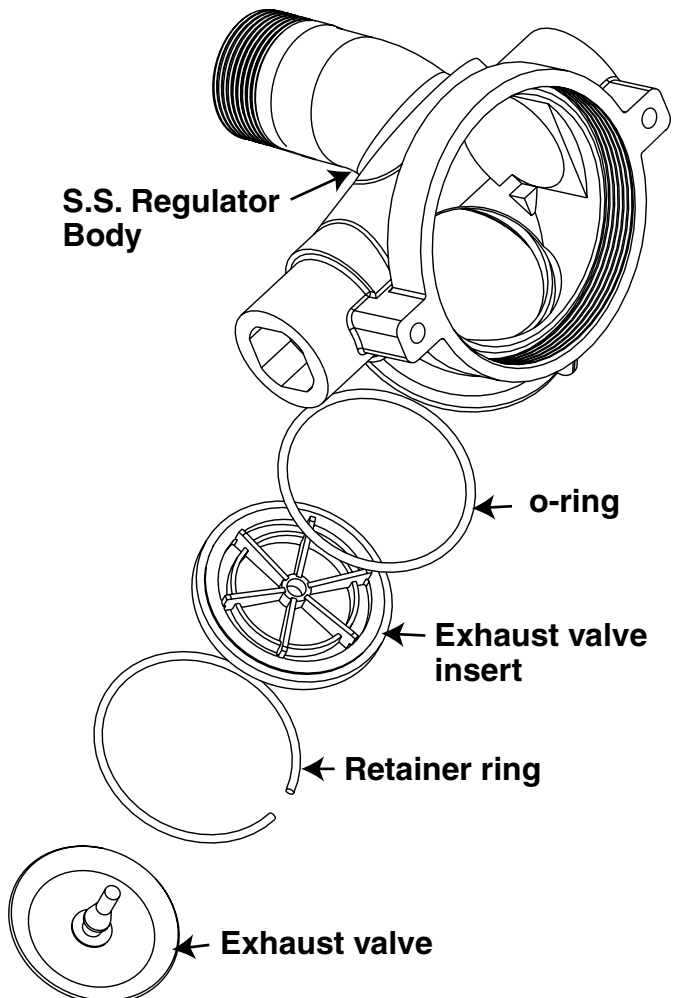
2) Install the o-ring into the regulator body.

3) Place the exhaust valve insert in the regulator body. The insert must be oriented so that it seals against the o-ring and the exhaust valve will mate properly with the insert.

4) Use a flat blade screwdriver to push the retainer clip into the opening in the regulator body for the exhaust valve insert. The clip should lock into place.

5) Install the exhaust valve into the exhaust valve insert. Cut off any excess tail from the exhaust valve that protrudes into the regulator body.

To test to see if the insert is installed properly, try to spin the insert. It should not turn. You should not be able to dislodge the insert by hand. Friction between the insert, the o-ring and the regulator body should hold the insert in its proper position.



SuperFlow 450 exhaust valve mechanism.



Install the o-ring on the main tube.



Install the o-ring on the inlet nipple.

6) Install the o-ring on the main tube. Lubricate with Christo-Lube.

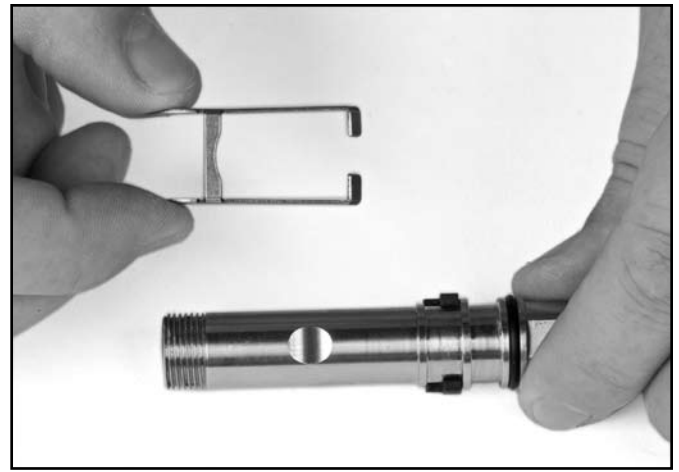
7) Install the o-ring on the adjustment nipple. Lubricate with Christo-Lube.

8) Install the o-ring on the balance spacer. Lubricate with Christo-Lube.

9) Install the bearing clip on the main tube. Note that there is a locating pin on the clip that must engage the correct hole on the main tube. The clip is correctly positioned when it is on the side opposite of the depression for the lever on the main tube.

10) Spread the arms of the lever just enough to install it on the main tube.

11) Study the features of the inlet valve assembly. There are four "wings" towards one end of the assembly and a bore that creates the balance chamber on the opposite end. The wings that align with the lever arm are the two that have an additional wall for the lever arm to bear on. The valve assembly should be inserted into the main tube with these walls toward the bottom of the regulator tube.



Install the lever on the main tube. Note the bearing clip fastens on the opposite side of the tube.

12) Using a clean wooden dowel rod, that has been sharpened in a pencil sharpener and inserted in the open end of the inlet valve, properly align and insert the inlet valve into the main tube. If this is done properly, the lever should lift up. If it does not, the valve has not been inserted correctly.

13) While holding the inlet valve in position, pull each arm of the lever outward just slightly until the inlet valves moves further into the main tube, approximately 1/4 inch. The dowel rod should move in a bit further to indicate that this has happened.



Install the inlet valve in the main tube.

14) Release your pressure on the dowel rod. The lever should fall back to its normal position against the main tube. Push in gently on the dowel and the lever should rise again. If this does not happen, the inlet valve is not installed correctly and must be reinstalled.

15) Remove the dowel rod and insert the spring and balance spacer into the main tube. Make sure the balance spacer is properly aligned inside the main tube by pushing in on the end of the spacer to see that it move inward (i.e., it engages the hole in the inlet valve).

16) Install the o-ring in the packing nut.

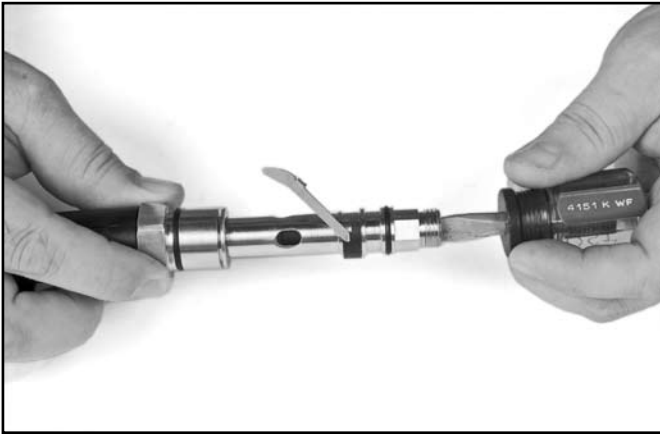
17) Fit the flattened end of the adjustment shaft into the flex knob.

18) Screw the adjustment shaft into the packing nut until it clicks.

19) Screw the packing nut and the entire flex knob assembly onto the main tube until it is hand tight.



Screw the flex knob assembly onto the main tube.



Screw the adjustment nipple into the open end of the main tube.

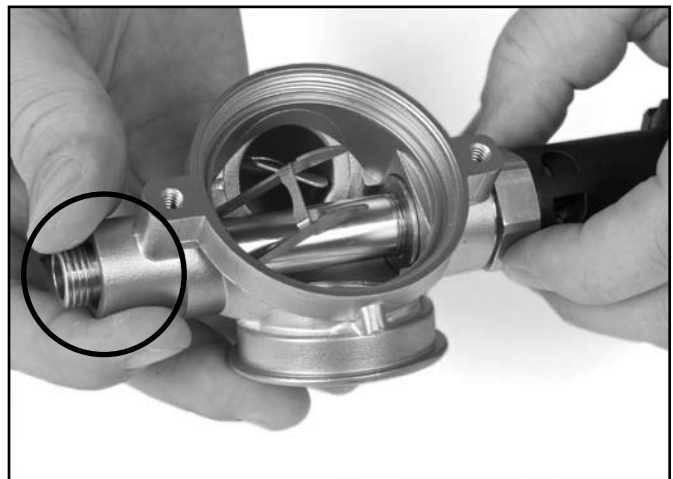
20) Screw the adjustment nipple into the main tube while watching for any movement of the lever (198). As soon as you see any movement of the lever, stop turning the nipple. Turn the nipple just enough so that the lever drops 1/8 inch.

21) Allow this assembly to sit for 24 hours so that the seat conforms to the adjustment nipple.

22) Carefully slide the main tube and associated parts into the regulator body.



Slide the main tube and associated parts into the regulator body.



The end of the threads on the main tube should be flush with the opening of the tube on the side of the regulator body.

23) If the main tube assembly has been properly installed in the regulator, the lever must be pointing straight up so that it will make contact with the diaphragm at the correct point. Note that the threaded end of the main tube where the bent tube adapter connects to it protrudes from the regulator body.

24) The flats on the main tube should be even with the outside end tube of the regulator body. If they are not, gently rotate the main tube assembly until flat surface on the main tube align with the flat surfaces inside the tube on the regulator body.

26) Loosen the packing nut from one to one and a half turns.

27) Install the bent tube adapter and torque to 30 inch pounds.



Thread the bent tube adapter onto the main tube.

28) Retighten the packing nut to 30 inch pounds.

29) Insert the lock clip into the groove on the packing nut inside the regulator body. Push down on the clip with a screwdriver until it is fully installed on the packing nut.

30) Turn the flex knob in towards the regulator body until you hear a click. This indicates the maximum distance the adjustment shaft will travel. Next, back the knob out completely until it stops.

Twist it just a but harder to make sure the packing does not come loose. Turn the knob all the way in and out three times.



Tighten the packing nut to 30 inch pounds.



Tighten the cover hand tight.



Make sure the lock clip fully engages the packing nut.

31) Install the diaphragm, cover and cover retaining ring. Tighten the retaining ring hand tight.

32) Install the screws and washers.

33) Test the regulator for proper adjustment. Follow the procedures in this chapter.

7.12.7 SuperFlow 450 Regulator Installation

Required Tools:

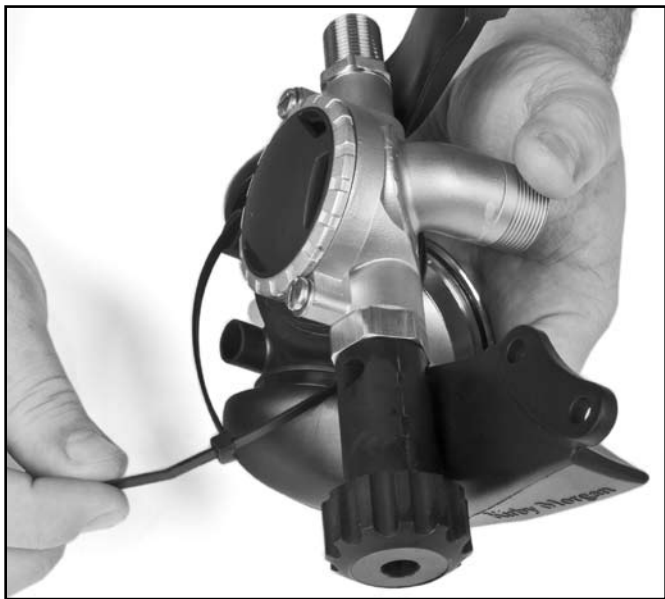
11/16 inch Open-end Attachment on Torque Wrench

7/8 inch Open-end Wrench, Torque Wrench and 1 3/8 inch Socket

1 /4 inch Flat Blade Attachment on Torque Screw-driver

1) Install the tie wrap on the center section of the exhaust whisker, named the exhaust main body and tighten.

2) Install the spacer on the regulator tube and install the regulator assembly and spacer on the helmet.



Install the tie wrap on the regulator.



Be sure to install the spacer on the regulator tube.



Install the o-ring that mounts on the regulator tube inside the helmet.



Install the regulator mount nut.



Tighten the screws that connect the quad exhaust cover to the exhaust body.



Connect the bent tube assembly and tighten at both ends.

- 3) Install the sealing o-ring and regulator mount nut. Do not tighten the nut at this time.
- 4) Tighten the screws that connect the exhaust main body to the quad exhaust cover.
- 5) Install the oral nasal mask per this chapter.
- 6) Install the nose block device per chapter 8.
- 7) Install the bent tube assembly, per this chapter.
- 8) Tighten the regulator mount nut to 75 inch pounds.
- 9) Install the screws, kidney plates and whisker spacers from the whiskers. Tighten the screws to 12 inch pounds.



Tighten the screws that fasten the whiskers to the helmet.